

Including Ham Radio Fun!

73. Amateur Radio Today

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International Edition

Software Home-brewing see page 10...

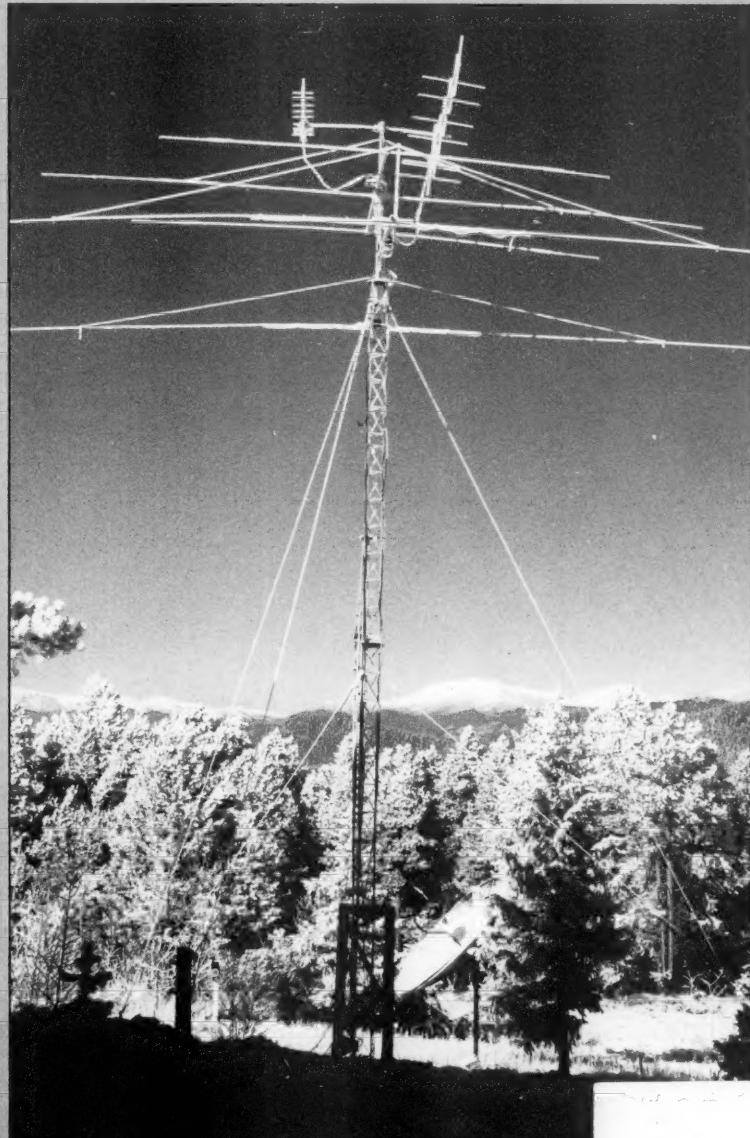


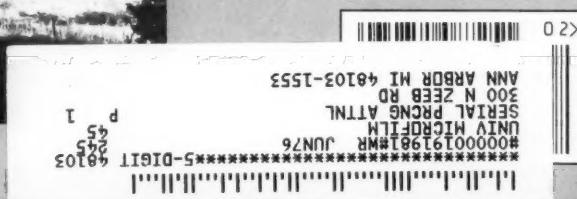
Photo by WØLMD

To Build:

- Beam-aimer
- Turbo Digi-sniffer
- Gel Cell Charger
- 160m Antenna Tuner
- Stealth Antennas

Reviews:

- Ten-Tec 6m Transverter
- Hamtronics RWX



JRC

JST-245

160-10 Meters PLUS 6 Meter Transceiver



Fifteen reasons why your next HF transceiver should be a JST-245. . .

- 1 All-Mode Operation (SSB,CW,AM,AFSK,FM) on all HF amateur bands and 6 meters. JST-145, same as JST-245 but without 6 meters and built-in antenna tuner.
★ **JST-145 COMING SOON ★**
- 2 MOSFET POWER AMPLIFIER • Final PA utilizes RF MOSFETs to achieve low distortion and high durability. Rated output is 10 to 150 watts on all bands including 6 meters.
- 3 AUTOMATIC ANTENNA TUNER • Auto tuner included as standard equipment. Tuner settings are automatically stored in memory for fast QSY.
- 4 MULTIPLE ANTENNA SELECTION • Three antenna connections are user selectable from front panel. Antenna selection can be stored in memory.
- 5 GENERAL COVERAGE RECEIVER • 100 kHz-30 MHz, plus 48-54 MHz receiver. Electronically tuned front-end filtering, quad-FET mixer and quadruple conversion system (triple conversion for FM) results in excellent dynamic range (>100dB) and 3rd order ICP of +20dBm.
- 6 IF BANDWIDTH FLEXIBILITY • Standard 2.4 kHz filter can be narrowed continuously to 800 Hz with variable Bandwidth Control (BWC). Narrow SSB and CW filters for 2nd and 3rd IF optional.
- 7 QRN SUPPRESSION • Other interference rejection features include Passband Shift (PBS), dual noise blanker, 3-step RF attenuation, IF notch filter, selectable AGC and all-mode squelch.
- 8 NOTCH TRACKING • Once tuned, the IF notch filter will track the offending heterodyne (± 10 KHz) if the VFO frequency is changed.
- 9 DDS PHASE LOCK LOOP SYSTEM • A single-crystal Direct Digital Synthesis system is utilized for very low phase noise.
- 10 CW FEATURES • Full break-in operation, variable CW pitch. built in electronic keyer up to 60 wpm.
- 11 DUAL VFOs • Two separate VFOs for split-frequency operation. Memory registers store most recent VFO frequency, mode, bandwidth and other important parameters for each band.
- 12 200 MEMORIES • Memory capacity of 200 channels, each of which store frequency, mode, AGC and bandwidth.
- 13 COMPUTER INTERFACE • Built-in RS-232C interface for advanced computer applications.
- 14 ERGONOMIC LAYOUT • Front panel features easy to read color LCD display and thoughtful placement of controls for ease of operation.
- 15 HEAVY-DUTY POWER SUPPLY • Built-in switching power supply with "silent" cooling system designed for continuous transmission at maximum output.

JRC*Japan Radio Co., Ltd.*

430 Park Ave., 2nd Floor New York, NY 10022

Phone: (212) 355-1180 Fax: (212) 319-5227

CIRCLE 159 ON READER SERVICE CARD

Have Beam, Will Travel!

Shake, twist—your walking stick becomes a beam!

How would you like a four element 2 meter yagi that travels the mountain trails as as walking stick? Pick a rest stop, remove the end cap, shake out the elements and feedline, and in two minutes your HT is full quieting wherever you point it.

Finished resting? Unscrew the elements and drop them into the boom; you're ready for travel. But whenever you get the urge, it's there, ready to zero in on a jammer, chase a radio fox, or shoot your signal out of a hole in time of difficulty.

What is it? ArrowBeam. It shoots straight and true, and its strong flexible elements are stored in the boom like arrows in a quiver. It weights only a pound and a half and is balanced in the hand, but it can take abuse.

Keep it in the trunk of the car. It's tough exterior protects everything against damage as it gets tossed and knocked about. But when it's time for action—shake, twist,

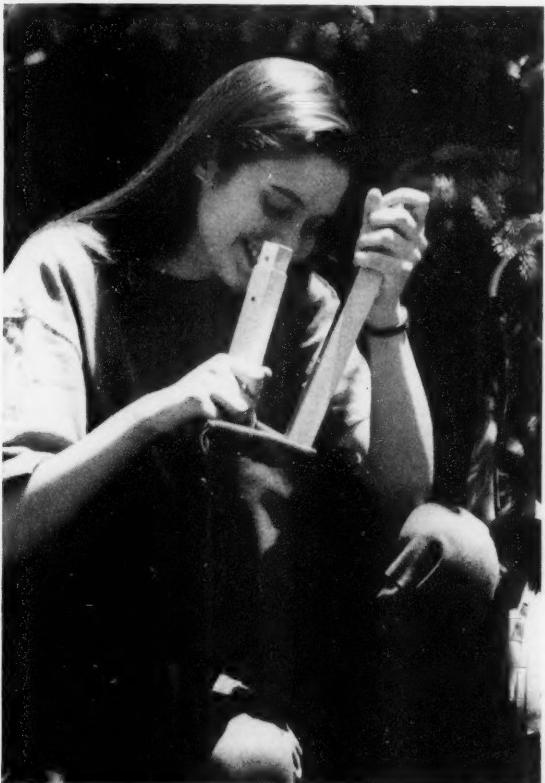
and ArrowBeam is ready to shoot your RF right where you want it.

This handy versatile antenna is made to be dropped, bumped, and stepped on while you are racing through brush and branches in pursuit of the elusive radio fox. Drop it? It bounces. Snag a low limb as you drive by? Twang! the tempered elements just spring back into position. Sit on it? You'll need a bandaid for your fancy, but ArrowBeam will be ready for more.

Of course ArrowBeam will do just fine in an attic or on a mast even though it's made for the torture of the T-hunt.

Performance? ArrowBeam scored best for its boom length at the Dayton VHF competition. It's the antenna chosen by the FAA for its spook beacon and rogue ELT search teams.

Now you can have ArrowBeam's performance and toughness for your radio adventures.



Half-Size ArrowBeam?

Now there's a version of ArrowBeam that breaks down to half the Walking Stick size—the Grab-N-Go Arrow Beam. For storage the boom separates at the center, so the whole antenna stores in half the length—perfect for slipping in a backpack.

You get the same great performance, the same ease of assembly, the same robust durability, but Grab-N-Go fits in your suitcase.

The Grab-N-Go Arrow Beam comes in its own forest green stuff sack. There's extra room there for other goodies you may wish to carry with your beam—feedline, homebrew PVC mast, omnidirectional Pico-J antenna, etc. This is the version Becca is taking on her trip.

ArrowBeams

- **Walking Stick 2m \$79**
Elements 4 Boom Length 48"
Gain 6.1 dB Front/Back 10.1 dB
SWR <1.1 min, <1.5 band edges
Add \$6 S&H

- **Grab-N-Go 2m \$89**
Same as above, but breaks down to <25" for storage. Mast mount and Forest Green Stuff Sack included.
Add \$6 S&H

- **Walking Stick 70cm \$49**
Elements 5 Boom Length 40"
Gain 7.3 dB Front/Back 12.1 dB
SWR <1.1 min, <1.5 band edges
Add \$5 S&H

Other Range Extenders

- Pico-J 2m \$19.95 ppd
- Pico-J 2m/70cm \$26 ppd
- 2m Packet Pico-J \$22 ppd
- TigerTail (2m/70cm) \$8 ppd

Save \$5

Order more than one item and knock \$5 and shipping off the price of each after the first.

Yes. Send ArrowBeam: WS2m WS70cm GnG 2m
 Yes. Send my Pico-J Model: TigerTail

Name _____

Call _____ Phone _____

Street _____ Apt. _____

City _____ State _____ Zip _____

Antennas West InfoPak \$1 Order Hotline 800 926 7373

CIRCLE 57 ON READER SERVICE CARD

NEW
SWITCHING POWER SUPPLIES
CONT. ICS WT.(LBS)

SS-25 20 25 4.2
SS-30 25 30 5.0

SL SERIES

SPECIAL FEATURES

- SOLID STATE ELECTRONICALLY REGULATED
- FOLD-BACK CURRENT LIMITING Protects Power Supply from excessive current & continuous shorted output
- CROWBAR OVER VOLTAGE PROTECTION on all Models except RS-3A, RS-4A, RS-5A, RS-4L, RS-5L
- MAINTAIN REGULATION & LOW RIPPLE at low line input Voltage
- HEAVY DUTY HEAT SINK • CHASSIS MOUNT FUSE
- THREE CONDUCTOR POWER CORD except for RS-3A
- ONE YEAR WARRANTY • MADE IN U.S.A.

ASTRON POWER SUPPLIES
• HEAVY DUTY • HIGH QUALITY • RUGGED • RELIABLE •
PERFORMANCE SPECIFICATIONS

- INPUT VOLTAGE: 105-125 VAC
- OUTPUT VOLTAGE: 13.8 VDC ± 0.05 volts (Internally Adjustable: 11-15 VDC)
- RIPPLE Less than 5mV peak to peak (full load & low line)
- All units available in 220 VAC input voltage (except for SL-11A)

RS-L SERIES

• LOW PROFILE POWER SUPPLY

MODEL	Colors	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H × W × D	Shipping Wt. (lbs.)
	Gray	Black			
SL-11A	•	•	7	11	2½ × 7½ × 9¾
SL-11R	•	•	7	11	2½ × 7 × 9¾
SL-11S	•	•	7	11	2½ × 7 × 9¾
SL-11R-RA	•	•	7	11	4¾ × 7 × 9¾

RM SERIES


MODEL RM-35M

• 19" RACK MOUNT POWER SUPPLIES

MODEL	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H × W × D	Shipping Wt. (lbs.)
RM-12A	9	12	5½ × 19 × 8½	16
RM-35A	25	35	5½ × 19 × 12½	38
RM-50A	37	50	5½ × 19 × 12½	50
RM-60A	50	55	7 × 19 × 12½	60

• Separate Volt and Amp Meters

MODEL	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H × W × D	Shipping Wt. (lbs.)
RM-12M	9	12	5½ × 19 × 8½	16
RM-35M	25	35	5½ × 19 × 12½	38
RM-50M	37	50	5½ × 19 × 12½	50
RM-60M	50	55	7 × 19 × 12½	60

RS-A SERIES

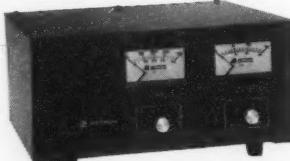

MODEL RS-7A

MODEL	Colors	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H × W × D	Shipping Wt. (lbs.)
	Gray	Black			
RS-3A	•	2.5	3	3 × 4¾ × 5¾	4
RS-4A	•	3	4	3¾ × 6½ × 9	5
RS-5A	•	4	5	3½ × 6½ × 7½	7
RS-7A	•	5	7	3¾ × 6½ × 9	9
RS-10A	•	7.5	10	4 × 7½ × 10¾	11
RS-12A	•	9	12	4½ × 8 × 9	13
RS-12B	•	9	12	4 × 7½ × 10¾	13
RS-20A	•	16	20	5 × 9 × 10½	18
RS-35A	•	25	35	5 × 11 × 11	27
RS-50A	•	37	50	6 × 13¾ × 11	46
RS-70A	•	57	70	6 × 13¾ × 12½	48

RS-M SERIES


MODEL RS-35M

MODEL	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H × W × D	Shipping Wt. (lbs.)
RS-12M	9	12	4½ × 8 × 9	13
RS-20M	16	20	5 × 9 × 10½	18
RS-35M	25	35	5 × 11 × 11	27
RS-50M	37	50	6 × 13¾ × 11	46
RS-70M	57	70	6 × 13¾ × 12½	48

VS-M AND VRM-M SERIES


MODEL VS-35M

• Separate Volt and Amp Meters • Output Voltage adjustable from 2-15 volts • Current limit adjustable from 1.5 amps to Full Load					
MODEL	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H × W × D	Shipping Wt. (lbs.)	
	@13.8VDC @10VDC @5VDC	@13.8V	H × W × D		
VS-12M	9	2	12	4½ × 8 × 9	13
VS-20M	16	4	20	5 × 9 × 10½	20
VS-35M	25	7	35	5 × 11 × 11	29
VS-50M	37	10	50	6 × 13¾ × 11	46
VS-70M	67	16	70	6 × 13¾ × 12½	48
VRM-35M	25	7	35	5¼ × 19 × 12½	38
VRM-50M	37	10	50	5¼ × 19 × 12½	50

RS-S SERIES


MODEL RS-12S

MODEL	Colors	Continuous Duty (Amps)	ICS* Amps	Size (IN) H × W × D	Shipping Wt. (lbs.)
	Gray	Black			
RS-7S	•	5	7	4 × 7½ × 10¾	10
RS-10S	•	7.5	10	4 × 7½ × 10¾	12
RS-12S	•	9	12	4½ × 8 × 9	13
RS-20S	•	16	20	5 × 9 × 10½	18
SL-11S	•	7	11	2½ × 7 × 9¾	12

*ICS—Intermittent Communication Service (50% Duty Cycle 5min. on 5 min. off)

CIRCLE 16 ON READER SERVICE CARD

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73 Including Ham Radio Fun!

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ISSUE #437

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On the cover: Photo by Bob Suding WØLMD, who explains: "The picture is my 2 el 40 beam, my 3 el 30, 17, & 12 beam and my 2 & 3/4 beams for OSCAR @ 8,950 feet. Distant mountains are 15 miles away @ 14,000 feet."

Feedback: Any circuit works better with feedback, so please take the time to report on how much you like, hate, or don't care one way or the other about the articles and columns in this issue. G = great!, O = okay, and U = ugh. The G's and O's will be continued. Enough U's and it's Silent Keysville. Hey, this is your communications medium, so don't just sit there scratching your...er...head. FYI: Feedback "number" is usually the page number on which the article or column starts.

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Contract: See where natural ham curiosity gets you! Upon finishing reading the first sentence, you have formally contracted with 73 Amateur Radio today to be our grass-roots ad salesman. You know we give you more ham fun for the buck than the rest—it should be a cinch to make this clear to dealers and manufacturers.

NEVER SAY DIE

Wayne Green W2NSD/1



"The Weather Here"

When I hear those words I'm pretty sure the chap on the other end is going to be a dud contact. I don't give a rat's rump what his weather is unless there's been a tornado or something really worth talking about. And I honestly don't care what commercial rig he was able to afford, so none of that "The rig here is..." stuff either. That, too, tells me that he hasn't given any thought about what might be of interest to me, that I am just another formula contact for him. Gee, maybe he "needs" a NH QSL. Wowie, oh thrill! That's worth 32¢ for me anytime, plus filling out the card and looking up his address in the *Callbook*. Sure.

When you call me I want to know something about you, not what kind of an antenna or what rig you bought. One of the reasons I wander off ham radio in my editorials is my obviously wasted effort to get you to at least ask someone you're talking with if they've read my latest crazy editorial. And I recommend books which would give you endless things to talk about, if only I could get you to read them. Sigh.

Yes, I'll send you a confounded QSL. Oh yes, and roger on your rig, your antenna, your weather, and the serial number on your mike. But are you active on packet, satellites, the Internet? Have you worked any interesting DX lately, maybe even been somewhere interesting? What do you think about the possible (maybe probable, considering the ARRL's undiplomatic actions) loss of 2 meters? Talk to me!

Boilerplate

While I was at it I also put together a collection of 43 of my ham-oriented editorials for ham

club newsletter editors to use as filler when their club members fail to provide enough fodder. Those small filler items in newspapers are called boilerplate.

I get around 50 club newsletters every month and while some are packed with interesting stories, others are awfully dull. Since only about 20% of the hams read 73, it seemed to me that my editorials would be new for most newsletter readers, and could use some repetition for the others. And no snide remarks about my own repetition, please.

Any newsletter editor interested in getting some interesting filler can send me a copy of the newsletter and I'll send a *Boilerplate* book. Yes, I can dump any desired segments to disk, if that'll help. Mac Word format. If you just have a morbid interest in my past ham-oriented editorials the collection is \$5. A steal.

Shocking

A newspaper article from Graham Rogers VK6RO cites another medical anomaly worth investigating. This has to do with a chap who was suffering from Ross River virus, which produces extreme fatigue and lasts a year or two. It's transmitted by mosquitoes. It seems this chap who was suffering from the virus had difficulty even getting out of bed. Then he accidentally got pushed into an electric fence and got a dandy shock. The next day he had recovered from the virus. He told a good friend of his who also was suffering from the virus about it. The friend came around and zapped himself on the fence and within 15 minutes his pains were gone.

Some time ago I wrote about the Amazon Indian cure for snake bite where they take the wire off their outboard motor spark plug and zap the bite to

counteract the venom. Indeed, the jungle aviation flyers take along a spark coil system in their planes just for that emergency.

This ties right in with the letter from KA1UMW ("Letters") and his experiences.

Now, I suppose you're going to ask me why the medical industry is blind to these anomalies. How can they pass up researching electrical approaches to curing illnesses? You wouldn't ask that if you'd read the exposé books on the industry on my recommended list. The big money in the \$1.5 trillion American medical industry is in selling medications. If the drug companies can't develop and patent a pharmaceutical which will bring in hundreds of millions, you aren't going to see it. Or have you bought any pills lately? And the pill and shot pushers are solidly backed up by the AMA, the FDA, and on down the list, complete with swat teams to put you in prison if you try to cause any trouble. Lordy, you should see some of the letters I've been getting from FDA prisoners around the country!

Perhaps you can understand why I'm so enthusiastic about the Beck blood purifier and Bioelectrifier (May issue).

Memorial

What do you want to be remembered for? If you ask a kid this he won't have an answer. It isn't until you're along in your 40s or so that you begin to understand what this means. We can't all leave great music or art behind as a memorial. Or even one stone in a great wall somewhere. So I sit here at my computer, listening to Gottschalk's incredibly beautiful music, goading you to help pioneer any of the endless frontiers of science which are wide open for exploration. Goading you to

produce and raise the very best children you can. Goading you to help fix our schools, our health care system, and all the other things you've let our beloved Congress and president, solidly backed up by millions of bureaucrats, screw up. Will your memorial be a work of art? A book? A discovery? A lifetime score of 370 countries worked? Or perhaps a bunch of certificates for winning contests which will eventually get thrown out with those old boxes of QSL cards by your widow? Or just a weathering stone in a cemetery somewhere?

It doesn't take a lot of money to pioneer. Mostly it takes determination.

Speaking of bureaucrats, here's a quote I like: "A bureaucrat is the most despicable of men, though he is needed as vultures are needed, but one hardly admires vultures whom bureaucrats strangely resemble. I have yet to meet a bureaucrat who was not petty, dull, almost witless, crafty, or stupid, an oppressor or a thief, a holder of a little authority in which he delights, as a boy delights in possessing a vicious dog. Who can trust such creatures?" Cicero, circa 50 BC. Who says we haven't made progress in 2,000 years?

There's a whole world of mystery out there, waiting to be unraveled. Pick any thread and see where it takes you.

Congratulations!

Paul Harvey mentioned that our total taxes are now an average of 50.4% of our earnings, setting a new record. This is truly remarkable because in most other countries the people have revolted when the taxes got over 33%. So you are to be congratulated on your ability to get thoroughly screwed and yet keep on cheerfully smiling and re-electing your screwers.

Yes, it's sure nice to have our social security payments when we get old. Of course, if the same money had been invested privately we'd be getting over three times as much back. And the system wouldn't be looking at bankruptcy in a few more years. Sure, it's nice to have Medicare too. And never mind that if the government would let us invest our pre-tax earnings in health care insurance we'd get much better care at less than a

Continued on page 31

Synthesized FM Stereo Transmitter



Microprocessor controlled for easy freq programming using DIP switches, no drift, your signal is rock solid all the time - just like the commercial stations. Audio quality is excellent, connect to the line output of any CD player, tape deck or mike mixer and you're on-the-air. Foreign buyers will appreciate the high power output capability of the FM-25; many Caribbean folks use a single FM-25 to cover the whole island! New, improved, clean and hum-free runs on either 12 VDC or 120 VAC. Kit comes complete with case set, whip antenna, 120 VAC power adapter - easy one evening assembly.

FM-25, Synthesized FM Stereo Transmitter Kit \$129.95

Tunable FM Stereo Transmitter

A lower cost alternative to our high performance transmitters. Offers great value, tunable over the 88-108 MHz FM broadcast band, plenty of power and our manual goes into great detail outlining aspects of antennas, transmitting range and the FCC rules and regulations. Connects to any cassette deck, CD player or mixer and you're on-the-air, you'll be amazed at the exceptional audio quality! Runs on internal 9V battery or external power from 5 to 15 VDC, or optional 120 VAC adapter. Add our matching case and whip antenna set for a nice finished look.

FM-10A, Tunable FM Stereo Transmitter Kit \$34.95
CFM, Matching Case and Antenna Set \$14.95

RF Power Booster Amplifier



Add some serious muscle to your signal, boost power up to 1 watt over a frequency range of 100 KHz to over 1000 MHz! Use as a lab amp for signal generators, plus many foreign users employ the LPA-1 to boost the power of their FM Stereo transmitters, providing radio service through an entire town. Power required: 12 to 15 volts DC at 250mA, gain of 3dB at 10 MHz, 10 dB at 1000 MHz. For a neat, professionally finished look, add the optional matching case set.

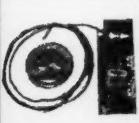
LPA-1, Power Booster Amplifier Kit \$39.95
CLPA, Matching Case Set for LPA-1 Kit \$14.95
LPA-1WT, Fully Wired LPA-1 with Case \$99.95

Micro FM Wireless Mike

World's smallest FM transmitter. Size of a sugar cube! Uses SMT (Surface Mount Technology) devices and mini electret condenser microphone, even the battery is included. We give you two complete sets of SMT parts to allow for any errors or mishaps-build it carefully and you've got extra SMT parts to build another! Audio quality and pick-up is unbelievable, transmission range up to 300 feet, tunable to anywhere in standard FM band 88 to 108 MHz. 7/8" w x 3/8" h x 3/4" t.

FM-5 Micro FM Wireless Mike Kit \$19.95

Crystal Controlled Wireless Mike



Super stable, drift free, not affected by temperature, metal or your body! Frequency is set by a crystal in the 2 meter Ham band of 146.535 MHz, easily picked up on any scanner radio or 2 meter rig. Changing the crystal to put frequency anywhere in the 140 to 160 MHz range-crystals cost only five or six dollars. Sensitive electret condenser mike picks up whispers anywhere in a room and transmit up to 1/4 mile. Powered by 3 volt Lithium or pair of watch batteries which are included. Uses the latest in SMT surface mount parts and we even include a few extras in case you sneeze and loose a part!

FM-6, Crystal Controlled FM Wireless Mike Kit \$39.95
FM-6WT Fully Wired FM-6 \$69.95

Call for our Free Catalog !

RAMSEY

Super Pro FM Stereo Radio Transmitter



A truly professional frequency synthesized FM Stereo transmitter station in one easy to use, handsome cabinet. Most radio stations require a whole equipment rack to hold all the features

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FM-100, Professional FM Stereo Transmitter Kit \$299.95
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SS-70AWT, Fully Wired SS-70A with Case \$79.95
AC12-5, 12 Volt DC Wall Plug Adapter \$9.95

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Dialed phone numbers, repeater codes, control codes, anywhere touch tones are used, your TG-1 will decode and store any number it hears. A simple hook-up to any radio speaker or phone line is all that is required, and since the TG-1 uses a central office quality decoder and microprocessor, it will decode digits at virtually any speed! A 256 digit non-volatile memory stores numbers for 100 years - even with the power turned off, and an 8 digit LED display allows you to scroll through anywhere in memory. To make it easy to pick out numbers and codes, a dash is inserted between any group or set of numbers that were decoded more than 2 seconds apart. The TG-1 runs from any 7 to 15 volt DC power source and is both voltage regulated and crystal controlled for the ultimate in stability. For stand-alone use add our matching case set for a clean, professionally finished project. We have a TG-1 connected up here at the Ramsey factory on the FM radio. It's fun to see the phone numbers that are dialed on the morning radio show!

Although the TG-1 requires less than an evening to assemble (and is fun to build, too!), we offer the TG-1 fully wired and tested in matching case for a special price.

TG-1, Tone Grabber Kit \$99.95
CTG, Matching Case Set for TG-1 Kit \$14.95
TG-1WT, Fully Wired Tone Grabber with Case \$149.95
AC12-5, 12 Volt DC Wall Plug Adapter \$9.95

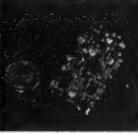
Mini-Peeper Micro Video Camera



Super small, high quality fully assembled B & W CCD TV camera the size of an ice cube! Provides excellent pictures in low light (2 lux), or use our IR-1 Infra-Red light source to invisibly illuminate an entire room on a pitch black night! Imagine the possibilities... build it into a smoke detector, wall clock, lamp, book, radio. Exact same camera that's in big buck catalogues and stores. Kit includes: fully assembled CCD camera module, connectors, interface PC board kit with proper voltage regulation and filtering, hook-up details, even a mini microphone for sensitive sound! Two models available: Wide Angle Lens 3.6mm/1.2, adjustable focus lens, 92 degree view; Pinhole Lens 5.5mm/1.6, 60 degree view. The Pinhole Lens is physically much flatter and provides even greater depth of field. The camera itself is 1.2" square. The Wide Angle Lens is about 1" long, Pinhole Lens about 1/2"; interface PC board is 1" x 2" and uses RCA jacks for easy hook-up to VCRs, TVs or cable runs. Power required is 9 to 14 VDC @ 150 mA. Resolution: 360 x 350 lines. Instruction manual contains ideas on mounting and disguising the Mini-Peeper along with info on adding one of our TV Transmitter kits (such as the MTV-7 unit below) for wireless transmission!

MP-1, Wide Angle Lens CCD TV Camera Outfit \$169.95
MP-1PH, Pin-Hole Lens CCD TV Camera Outfit \$189.95

MicroStation Synthesized UHF TV Transmitter



Now you can be in the same league as James Bond. This transmitter is so small that it can fit into a pack of cigarettes - even including a CCD TV camera and battery! Model airplane enthusiasts put the MTV-7A into airplanes for a dynamic view from the cockpit, and the MTV-7A is the transmitter of choice for balloon launches. Transmitter features synthesized, crystal controlled operation for drift-free transmission of both audio and video on your choice of frequencies: Standard UHF TV Channel 52 (which should only be used outside of the USA to avoid violating FCC rules), and 439.25 MHz or 911.25 MHz which are in the amateur ham bands. The 439.25 MHz unit has the nifty advantage of being able to be received on a regular 'cable-ready' TV set tuned to Cable channel 68, or use our AT-74 converter and receive it on regular TV channel 3. The 911.25 MHz unit is suited for applications where reception on a regular TV is not desired, an AT-79 must be used for operation. The MTV-7A's output power is almost 100 mW, so transmitting range is pretty much 'line-of-sight' which can mean many miles! The MTV-7A accepts standard black and white or color video and has its own, on-board, sensitive electret microphone. The MTV-7A is available in kit form or fully wired and tested. Since the latest in SMT (Surface Mount Technology) is used to provide for the smallest possible size, the kit version is recommended for experienced builders only. Runs on 12 VDC @ 150 mA and includes a regulated power source for a CCD camera.

MTV-7A, UHF TV Channel 52 Transmitter Kit \$159.95
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ATV-79WT, Fully Wired 911.25 MHz Converter \$269.95

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LETTERS

From the Ham Shack

Mike Zane K6URI. Late last year I wrote to you commenting on an editorial and mentioning our school ham radio club. You asked for information and photos. Here's the story.

First I contacted all the high school, junior high and elementary schools in our district to see if I could generate any interest in starting ham radio clubs. The three high schools, three junior highs and all but one elementary school were not interested. The only elementary school principal who was interested was one that my wife had taught for previously.

We started out in January 1992 in a portable classroom that was being used as a library. I drove my truck near the front door so we could use the mobile antenna with a portable rig set up in the room. This was not an ideal setup, but at least we could make local contacts. This got some students interested. We now have a locked cabinet on the stage of the auditorium/cafeteria.

We meet only one day a week for one hour after school. Some school terms I have eight to 10 students, and sometimes only three to five. Our school district is so overcrowded that the students are on a three-track system: on four months and off two months. Most of the kids do not come on their off-track time.

It took almost four months for the administration (not the principal) to give their "permission" to start the club. The only requirements were these: The kids had to have a ride home after school (those who were bused); the club was at *no cost* to the district or school; and I couldn't electrocute any of the kids. So far, we have met all three requirements. Through equipment donations, money for study books from our local adult city club, and my junk box, we have a pretty good setup. The station has an MFJ-1270c TNC, a Kenwood 10W TR-7600a, Kenwood TS-520s, Swan SWR/wattmeter, and a 386DX-40 computer. On the roof of the auditorium we have a 2m antenna and a 20/40m trap dipole.

Recently my wife Kristy KE6IQL got her Technician license and we decided to try to start another club at the elementary school where she teaches sixth grade. We got the principal to let us put a packet station in the classroom as a test. So, when she returns to school from off track, we will give it a go.

Our club at Nichols Elementary starts the kids out with some electricity experiments and then they build a basic crystal radio. The next item is a Morse code key, followed by a two-transistor code oscillator. Then the crystal radio is converted to a one-transistor AM radio, and a small audio amplifier is added. By

the way, our club has students from grades four through six. Hopefully at the end of October, when my wife goes back on track, we will have another club going and good news to report. I would like to be able to have the club members at both schools get on ATV, which might generate some more interest.

Harry Goldman, Tesla Coil Builders Assn.

Does Bernard Finn have a problem? ("Letters," August 1996.) Mention Nikola Tesla and he gives a list of also rans. I call it the "Oh but..." syndrome. That is, you credit a person for his contributions to science and Finn comes up with the "Oh buts..." This game can be applied to anyone, Bell and the telephone, for example, as well as Edison for the incandescent lamp and the phonograph. It is no secret that there were others on their trail. And that's the crux of the argument—they were trailing and not leading. Surely Mr. Finn is aware of the fact that the Tesla polyphase patents were dragged through the courts. Although the courts considered the efforts of others, including those named by Finn, Tesla's patents were upheld in every case. When Niagara went on line in 1896, the famous Lord Kelvin declared that "Tesla had contributed more to electrical science than any man up to his time." Whew, that takes in a bunch of highly respected names.

I agree with Mr. Finn that Edison's incandescent lamp established a need for a source of electricity. But there were single-phase AC systems available at the time. Why, then, did so many years pass between the birth of the incandescent lamp and Niagara hydroelectric power? It is no coincidence that Niagara hydroelectric came into existence shortly after the appearance of Tesla's patents.

Much of the discussion above can be applied to the wireless telegraphy controversy. By 1893 Tesla had developed the principle of the four-circuit system of communications. The idea employed inductive coupling between the driving and working circuit, the importance of tuning both circuits, the idea of an oscillation transformer, the capacitance loaded open secondary, and tuned antenna circuits grounded at one end. Again, I

agree with Mr. Finn that there were others who later applied their own innovative ideas. But they would have gotten nowhere without employing the above named components. The way to wireless telegraphy was through Tesla.

Tesla's contributions to wireless telegraphy did not go unnoticed by his peers. Tesla was hailed as the "father" of wireless telegraphy by L.W. Austin (leading U.S. Government radio expert), M.E. Giradeau (pioneer in French communications), A. Slaby (whose work helped to establish the Telefunken system in Germany), A. Popov (often referred to as the Russian Marconi), as well as by others. E.H. Armstrong (FM and advanced radio circuits) praised Tesla for his visionary work in wireless and credited Tesla as the originator of radio control systems. John S. Stone (named in the U.S. Supreme Court decision) stated that "Tesla was so far ahead of his time that the best of us mistook him for a dreamer."

With numerous awards, 15 honorary doctorates, a unit of measurement bearing his name, an IEEE annual award presented in his honor, and so on, it is difficult to understand why the Smithsonian can ignore Tesla's accomplishments.

The lack of artifacts is given as one reason. That situation did not stop MGM when it was preparing for the 1940 film "Edison, the Man." The studio sent its craftsmen to museums with Edison holdings to take photographs and make measurements. It took only six weeks to replicate Edison's most important inventions, and that includes the Pearl Street generating station. These were not Hollywood props but 1:1 scale working models! Tesla artifacts are in abundance at the Tesla Museum in Belgrade. I am confident that the Smithsonian crafts department is just as capable as MGM's.

Even if artifacts are lacking, the Smithsonian has numerous papers on Tesla's work that have been donated by engineers and historians. Why hasn't the Smithsonian used them to publish a monograph on Tesla?

And in conclusion, I might as well mention my own personal complaint. In 1994, a friend stated that he saw a portrait of Tesla at



Members of K6URI's elementary school club working on their crystal radios.

the Smithsonian. Thinking that it might be something I do not already have, I sent a request for information. Two years have passed without a satisfactory reply even though I have sent reminders on two subsequent occasions.

The situation is a disgrace—another example of politics messing things up... Wayne.

Raymond Bergeron KA1UMW.

When I was less than 12, I saw a little German chiropractor (Dr. Leonard A. Kaam) for relief from bronchitis symptoms, for an injury from a tree fall, and for Osgood Slatter's disease. This chiropractor had a "little black box" that ran on batteries. I would hold a solid brass probe in one hand while he probed the affected area with the other. He had a small figurine of the human body that was covered with numbers. When he wanted to treat my ailment or symptom (stuffed-up sinuses, for example), he would look up sinuses in a book. The book would give him a list of numbers which he would find on the figurine. He said that the numbers were nerve ending points. Using his probe, he would touch the area of my body as indicated by the numbers. A tone would come from the box and get louder as he approached the nerve ending (presumably by finding the least resistance). When the tone was the highest in pitch he would push a button on the probe and a series of electric pulses would run through me (they would often be a little painful) for about five seconds. After a few of these hits (around the nose for the sinus treatment), I would feel the dams bursting and my sinuses would be instantly clear, with the gunk running down the back of my throat. He would always tell me that his box could cure anything, clear up a blocked artery, etc. He even said if I ever had a heart attack or a stroke, not to go to the hospital but to go see him and he would clear it up instantly.

Well, he also had another gray box called a Century Mach IV Galvanic Stimulator. This little device had a big pad that was soaked in warm water and placed on your back, and two smaller wet pads that are placed on the injured

area. The machine would run an AC current through your body. The current was variable from nothing to painful, at a frequency from 30 to 120 Hz. The current would switch from Pad A to Pad B, going to the big common pad on your back at a rate of 2.5, 5, or 10 seconds. Well, as a late teen-and early 20-ager I started to service these little gray machines, which reportedly cost \$5,000. My chiropractor managed to get a schematic for me so I could repair them. The unit was just a simple 36-volt pulsed variable-current generator, with a timer—sound familiar?

If you have any chiropractor friends ask them about the physics involved and it may help with the plant growth stimulator.

Hmm, is this another lost technology? Seems worthwhile investigating. Were those "nerve endings" actually acupuncture points? Maybe some of those fancy electrical gadgets of long ago which the "modern" medical industry ridicules actually did work! Of course, if your pioneering spirit has been totally decimated, then never mind. And for heaven's sake don't read the Robert Becker books... Wayne.

Mike Truax KB9OCE. Wayne, you recently asked to hear about Elmers, so I thought I would tell you about my Elmer: my brother Jerry Truax N3SEI. I first became interested in amateur radio 22 years ago. My main interest then, as it is now, was HF. I have an HW-9 that I built in the late eighties which has yet to go on the air. Every time I was ready to take the test, I either couldn't find the time and place of a test, or I was working. Finally, in June this year, after calling off from work, I took the test. I had originally planned on going for Tech+. However, when the VEs told me that I had only missed two on the entire exam, I was so excited that I knew I'd never be able to concentrate on the code. I raced home to call my brother with the good news. His encouragement (and stubbornness) had finally paid off. A few days later I received a package from him. He had sent me a 2m HT so that I could get on the air as soon as my license arrived! There was one string attached. Now I have to

become an Elmer, and the first one that I Elmer gets the HT upon passing the exam... with the same string attached. That's a new twist on "incentive licensing" for sure!

I now have to study for the General. I wish I had done this years ago. Most of the blame is my own; however, for the general public, VE exams are one of the best-kept secrets around. I really think that our ranks would grow faster (and stronger) if more people knew about them. Our local Radio Shack™ knew nothing about local amateur radio activities, other than what I relayed to them. Most newspapers have a "community bulletin board" column. The newspapers can't print dates for VE exams or local club meetings, etc., if they don't know about them. The best part is that this is free advertising!

I suggest coverage of activities like Skywarn, Field Day, hamfests; the list goes on. I would really love to see an article about Bill KA9ONS, one of our local amateurs who normally runs our Weathernet. Bill and the guys do such a fantastic job. They too are

part of the reason that I finally took time to get licensed. Hmmm, since I am a free-lance writer, maybe I'll write the article—after all, if we don't promote ourselves, nobody else will! Maybe our local club (and yours) could use a Publicity Chairman. Volunteer! Remember the old saying: "Volunteers can't be bought; they're priceless." It's true! Don't worry, Wayne, I have a few articles in the works for you that I will be sending as soon as my research is complete. We could trade my work for back issues of 73. After all, they don't call you Never Spend a Dollar for nothing.

I would like to thank not only my brother Jerry N3SEI, but also you, Wayne, for the encouragement through your editorials (yes, somebody was listening!), Gordon West for his excellent study materials, our local Skywarn Weathernet, and our local VEs—John KF9YS, Mike WT9W, and Stan KD9BE—for giving up their valuable time so that a 22-year dream could become reality. Each and every one of you is my Elmer in your own way, and you

Continued on page 60

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Scholarships for Licensed Hams

The Foundation for Amateur Radio, Inc., a non-profit organization with headquarters in Washington D.C., plans to administer 60 scholarships for the academic year 1997-1998 to assist licensed radio amateurs. The Foundation, composed of over 75 local area amateur radio clubs, fully funds five of these scholarships with the income from grants and its annual Hamfest. The remaining 55 are administered by the Foundation without cost to the various donors.

Licensed radio amateurs may compete for these awards if they plan to pursue a full-time course of studies beyond high school and are enrolled in or have been accepted for enrollment at an accredited university, college or technical school. The awards range from \$500 to \$2,500, with preference given in some cases to residents of specified geographical areas or the pursuit of certain study programs. Clubs, especially those in Delaware, Florida, Maine, Maryland, New Jersey, Ohio, Pennsylvania, Texas, Virginia, and Wisconsin, are encouraged to announce these opportunities at their meetings, in their club newsletters, during training classes, on their nets and on the World Wide Web home pages.

Additional information and an application form may be requested by letter or QSL card, postmarked prior to April 30, 1997, from:

FAR Scholarships
6903 Rhode Island Avenue
College Park MD 20740

The Foundation for Amateur Radio, incorporated in the District of Columbia, is an exempt organization under Section 501(C)(3) of the Internal Revenue Code of 1954. It is devoted exclusively to promoting the interests of amateur radio and those scientific, literary and educational pursuits that advance the purposes of the Amateur Radio Service.

73's "Survey" Winner

The winner of \$100 plus a lifetime subscription to 73 is Harry Longerich of Fredericksburg, TX. Congratulations, Harry, and thank you for participating in the "Survey" in 73's November issue.

Cities Will Challenge FCC

Look for major court challenges by city planners, community managers, and homeowners' associations to recent rulings by the FCC—rulings that forbid states, cities, municipalities, homeowners' associations, and even individual landlords from enacting rules preventing the installation of those pizza-sized satellite TV dishes.

When it used its power and preempted local jurisdiction and land use regulations to permit anyone to install one of the mini satellite antennas, the FCC said it was doing so to ensure that the general

public had access to the latest in television transmission technology.

But according to recent news reports, some cities, states, and many homeowners' organizations disagree. A spokesman for a coalition of urban planning groups say that the federal government has no right to dictate the aesthetic look of a community; that controlling satellite dishes and any antenna structures must be done on a community planning level.

With both sides now having their views cast in concrete, it will be up to the legal system to decide who has the final word. Urban planners say that they will be going to court in an all-or-nothing effort to wrestle the power of federal preemption away from the FCC. While it will be many years before any final determination is made, whatever the outcome, the future of many radio services that use visible antennas—including amateur radio—may well hang in the balance.

Adapted from an editorial in the "marcKey," official newsletter of the Manteca ARC, November 1996.

Ham's Best Friend

- ...like man's in general, is the dog. Why?
- 10. He doesn't need a chair.
- 9. He always answers your call.
- 8. He entertains you when the bands are dead.
- 7. He keeps your feet warm on cold winter nights.
- 6. He never reminds you how late it is.
- 5. He understands your frustration; he's been in a few dogfights himself.
- 4. He doesn't talk while you're trying to copy code.
- 3. He's one being whose CW skills are worse than yours.
- 2. He doesn't care how much you spend on QRP gear.
- 1. He listens before he barks.

By Steve Burel AD4LY (lifted from the "ARNS Bulletin," December 1996, which lifted it from the Colorado QRP Club's official newsletter, "The Low Down.")

FCC Enacts Morse Code Requirement on Internet Access

(Note for the humor-impaired: This is satire. Please do not read this if you are not properly trained and certified in satire.)

The FCC, under pressure to clean up the Internet, especially after the Communications Decency Act provisions regarding Internet content were stricken as violating the U.S. Constitution, has decided instead to enact a Morse code proficiency requirement for Internet users. Citing the success of the Amateur Radio Service and the general belief that its requirement to operators to pass a Morse code proficiency exam, and other technical requirements, has kept the ARS "clean," the FCC will enact a 5 word-per-minute requirement for all Internet users. They are leaving open the issue of whether there should be a "codeless" class of Internet user and

are soliciting comments for proposed rule making on this proposal.

Persons wishing to develop a web site having only links to other web sites which in turn have only links to other web sites, and so forth, must pass a 13 word-per-minute Morse code test and demonstrate proficiency in HTML, the Internet authoring language.

Persons who wish to develop web sites that have actual content, as compared to just links to other web sites, must pass a 20 word-per-minute Morse proficiency test, demonstrate proficiency in HTML and the Java programming language, and show that they have mastery of at least one human language, such as English.

The FCC, which lacks budgetary authority to implement the testing program, has stated that it intends to create a Volunteer Examiner Program to test Internet applicants.

Swiped in its entirety from Clear Lake ARC's "Radio Amateur Gazette," October/November 1996.

Tucker Out of Ham Biz

Tucker Electronics Company, a distributor of new and reconditioned electronic test and measurement equipment, amateur and shortwave radios, and electronic hobbyist products, has announced the sale of all its ham radio-related assets (including the recently acquired Oklahoma Comm Center) to Ham Radio Outlet.

Tucker Electronics has discontinued operations of its retail store in Dallas and its consumer mail-order business; the toll-free ordering number is being serviced through HRO's New Hampshire store. At last report, Tucker is marketing its vintage radios and any inventory not acquired by HRO on its web site (www.tucker.com).

The sale of its amateur radio business will allow Tucker Electronics to focus on its core business, distributing new and reconditioned electronic test and measurement equipment.

Nautical Smiles

The following transcript of a radio conversation between a US Navy ship and a Canadian source off the coast of Newfoundland was released by the Chief of Naval Operations on Oct. 10:

US Ship: Please divert your course 15 degrees to the north to avoid a collision.

Canadian: Recommend you divert YOUR course 15 degrees.

US Ship: This is the captain of a US Navy ship. I say again, divert your course.

Canadian: No, I say again, divert YOUR course.

US Ship: This is an aircraft carrier of the US Navy. We are a large warship. Divert your course now!

Canadian: This is a lighthouse. Your call...

Reprinted from the newsletter of the Escondido Amateur Radio Society, November 1996, who reprinted it from Ham Radio Online Internet magazine.

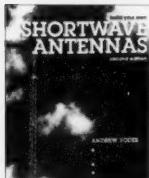
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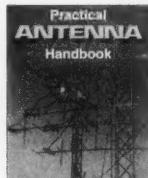
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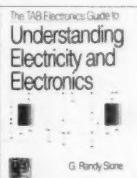
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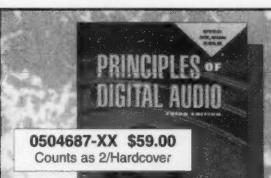
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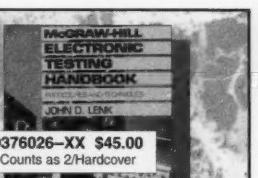
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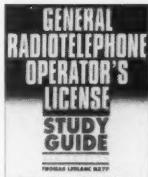
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STAR297

Amateur Radio and Linux

Software home-brewing is here!

Richard Parry W9IF
13842 Deergrass Court
Poway CA 92064-2276

October 5, 1991: "Do you pine for the nice days of Minix-1.1, when men were men and wrote their own device drivers? Are you without a nice project and just dying to cut your teeth on an OS you can try to modify for your needs? Are you finding it frustrating when everything works on Minix? No more all-nighters to get a nifty program working? Then this post might be just for you."

With that simple introduction, Linus Torvalds, a Finnish graduate student, announced to the world Version 0.02 of Linux on the USENET newsgroup comp.os.minix. Linux is pronounced

the kernel or core of the operating system; however, in general it represents all the software that normally comes with a complete distribution. Platforms upon which Linux runs include: DEC Alpha, Commodore AMIGA, Sun Sparc, MIPS, Atari ST, and Apple Macintosh. However, without a doubt, the 386, 486, and Pentium based systems are the most popular. Linux is not copyrighted and there is no AT&T code included (UNIX was born at AT&T). Linux is licensed under the Free Software Foundation's General Public License which specifies, among other things, that the source code must be freely available. It is the

Who is it for?

At the PACIFICON conference Bruce Perens AB6YM commented, "There's a saying that marketing people have about programmers: 'Leave a programmer alone, and he'll come up with the kind of product that only a programmer could love.' That's what UNIX is, and Linux too. Actually, other kinds of propeller-heads such as hardware designers, mathematicians, etc. have been known to be comfortable with UNIX and Linux. But why use an operating system that only a nerd could love? Well, you want them to write more software, don't you? UNIX and Linux are the most comfortable

"Where else but with Linux can you get the complete source code for a C++ compiler, an operating system, and the support of hundreds of thousands of users worldwide?"

"Lean-nucks," based on the Finnish pronunciation of Linus. Linux is a perfect platform for software development for amateur radio. It offers a plethora of freely distributed high quality software and a knowledgeable and helpful community of people (very much like the amateur radio community) ready, willing, and able to help; kind of like a ham's "Elmer." Although credit for the original idea for Linux must go to Linus Torvalds, the kernel and copious other software are the result of an international collaboration of dedicated people.

No doubt the gamut of readers of this article range from those who use Linux on a daily basis at work and/or home to those who have never heard of it. For those who fall into the latter category, Linux is a 32-bit, multi-tasking, multi-user, freely distributed UNIX-like operating system. Technically, Linux is only

inclusion of the source code that is perhaps most unique. If you ever wondered how an operating system, network, compiler, assembler, or editor works, it is all there for you to study and modify to your heart's content.

There was a time when most ham radio operators built all or part of their amateur radio stations. I have built my share of transmitters, electronic keyers, RTTY widgets, antennas and more. The desire to build was based on the thrill of learning and building. In fact, I remember taking months to build a nifty gadget for the shack, using it for a week to see if it worked, and then returning to thinking of something else to build. I believe most of the amateur radio community feels the same way. However, homebrewing now includes software, and for that development Linux is the perfect platform.

platforms for the development of sophisticated software that communicates, controls hardware, does complicated math ... what I'm trying to say is that it's the best platform for developing the kinds of software that radio amateurs need."

Who is Linux for? "Not for everyone" is the simple answer. Linux and UNIX are industrial grade operating systems. They both support a wide variety of GUIs (Graphical User Interfaces), but they are predominately a CLI (Command Line Interface). They are powerful, but with power and flexibility comes some complexity. Matt Welsh begins his book (see references) with, "Before you looms one of the most complex and utterly intimidating systems ever written: Linux, the free UNIX clone for the personal computer, produced by a mish-mash team of UNIX gurus, hackers, and

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10 Ways to Tell if Linux is for You
1. You don't own DOS for DUMMIES.
2. You don't hate typing.
3. You don't mind reading manuals.
4. You don't like going to bed before midnight.
5. You don't own Internet for Idiots.
6. You do like learning.
7. You do like challenges.
8. You do like to build.
9. You do like to experiment.
10. You can stop the VCR from blinking 12:00.

Table 1. A humorous checklist to aid you in making the decision to use Linux. However, as with all humor, there is always an element of truth.

the occasional loon. The system itself reflects this complex heritage, and although the development of Linux may appear to be a disorganized volunteer effort, the system is powerful, fast, and free. It is a true 32-bit operating system solution."

If Matt's introduction has not scared you, then a more humorous test to see if you are ready for Linux is included in **Table 1**. Since you probably already have the hardware, a personal computer, and Linux is free, you have nothing to lose and a whole lot to gain. UNIX and Linux experience on a resume never hurt anyone!

What's available?

Just about everything you can imagine for serious software development is available for Linux. But that is only part of the story. The fact that it all comes with the source code and the enthusiastic support of authors and users worldwide means you can probably get an answer to your question within hours, and that includes 3 a.m. Much of the documentation for Linux comes from the Linux Documentation Project (LDP) in the form of HOWTOs. These documents typically range from 10 to 50 pages and provide in-depth information on a particular subject. There are currently 50+ HOWTOs to aid the user with Ethernet, XFree86, sound, video, networking, and more. For the amateur radio community, there are two in particular, a HAM and AX.25 HOWTO. **Table 2** is based on the HAM HOWTO and includes a

summary of the software available for amateur radio. This document and other HOWTOs can be obtained from: <http://sunsite.unc.edu/mdw/HOWTO> and other mirror sites.

However, the purpose of this article and of Linux is not to get you started assembling a computer system based completely on applications that you can download; it is to inform the amateur radio community of an operating system (OS) that is an experimenter's dream. Here is your chance to learn C, C++, Perl, awk, Smalltalk, Tcl/Tk, FORTRAN, Python, shell scripts, networking, real-time systems, and more. It is a chance to put together a TCP/IP packet network that cannot be duplicated on any other platform. The reason for this is that the packet radio protocol is now built right into the kernel. Linux is the only operating system in the world that can boast standard and native support for amateur radio protocols. In fact, packet radio uses the same interface as the Internet. Therefore, any program which you use on the Internet can also be used as a packet radio program. For example, your favorite Internet programs such as Netscape, Mosaic, telnet, and ftp will work and not care, or know, that the medium they are using is packet radio.

Getting started

Table 3 shows the hardware for a comfortable system upon which to install Linux. I want to emphasize the word "comfortable," since you can get away with a lot less, especially hard drive space. However, most of you are not going to give up DOS or Windows 3.x right away (this might eventually happen, however) so you will want to make a partition on the hard disk for your DOS environment and another for Linux. One of the great benefits of Linux is that you don't have to give up anything you currently use. If you fear that Linux means leaving your current OS behind, fear not, Linux offers emulations for DOS, SVR3 UNIX, SVR4 UNIX, Macintosh and even older computers such as the Apple II and Commodore 64. For those of you who like GUIs, Linux has many to choose from. There are several versions of X Windows, including: twm, fvwm, and

Packet Radio
JNOS
TNOS
NØARY Packet BBS for UN*X
LBBS - Linux BBS message gateway
MBL/RLL message to NNTP and E-mail converter
Packet Cluster Node software
Single floppy disk AX.25 router
DPTNT Terminal & BBS package
IPIP encapsulation daemon
AXIP encapsulation daemon
Ping-Pong Convers Server
RSPF Daemon
Michael Westfall's TTYLINK Daemon
Craig Small's TTYLINK Daemon
Morse Code
GW4PTS Morse Trainer
morse (aka superiomorse)
AMTOR Software
PACTOR Software
Slow-Scan Television Software
Facsimile Software
Design and Construction Software
Software oscilloscope
Printed circuit board design tool
Chipmunk circuit design and simulation tool
irism
Spice vers. 3f4
svgafft - Spectrum Analyser
Audio Spectrum Analyser
ObjectProDSP
Training/Educational Software
Miscellaneous Software
Linux for HAMS CD-ROM
SunClock
Xearth

Table 2. Partial list of amateur radio Linux software taken from the HAM HOWTO documentation written by Terry Dawson VK2KTJ. The entire HOWTO is available at: <http://sunsite.unc.edu/mdw/HOWTO/HAM-HOWTO.html>.

386 machine or better.

8 MB RAM (more is better).

20 MB hard drive (SCSI, IDE, etc.).

Floppy drive (1.44 MB high density).

CD-ROM (any speed, SCSI, IDE, etc.).

Video card supported by Linux.

Mouse (3-button type preferred).

Table 3. Linux runs on many platforms; however, for most hams the platform of choice is the PC. Shown here is a good hardware configuration for Linux software development.

others. X Windows is a very powerful interface which allows great configuration flexibility.

Regarding file formats, as you survey the various distributions you will come across the terms "a.out" and "ELF" (Executable and Linking Format). Both are binary formats, the former being used for many years but now falling into disuse due to the advantages of ELF. The Linux community supports both formats during the current transition period. All of the distributions listed in **Table 4** support ELF.

During the installation of Linux you will be asked questions about your system's hardware configuration. Chances are you are using standard port assignments and addresses and the installation will go smoothly, but you should have your documentation handy just in case. For example, you might need to know your serial and parallel ports' I/O memory locations, and the IRQ (interrupt) addresses for devices (e.g., serial ports, sound cards, SCSI ports, video card, etc.). If you are not sure, most of the scripts have a default value to suggest, and in most cases you can't go too far astray sticking to the defaults in lieu of firsthand knowledge. Unless you have done

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M120, GM300, GR300 repeaters, & M120.

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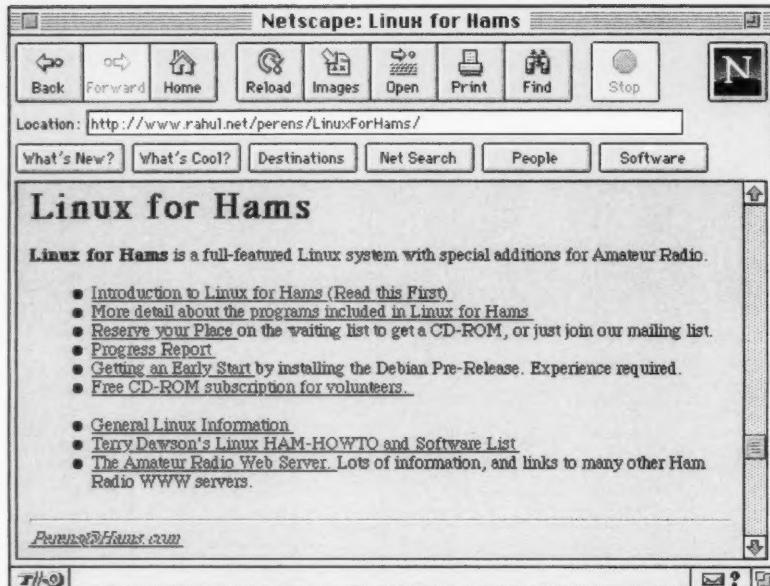


Fig. 1. The Linux for Hams homepage maintained by Bruce Perens AB6YM. Available at: <http://www.raul.net/persens/LinuxForHams/>.

something strange with your hardware configuration, the defaults should work fine.

Although I said that everything for Linux is free and can be downloaded from the Internet, I would not advise that for anyone, even a UNIX guru. A small Linux installation can consist of a thousand or more files easily consuming 50+ MB of space. A complete installation which includes source code, copious documentation, computer languages and examples, and the X Window system can easily take up much more (e.g. 500+ MB). For this reason downloading is not practical. Fortunately, there are many CD-ROM publishers who include a complete distribution of Linux along with excellent installation software.

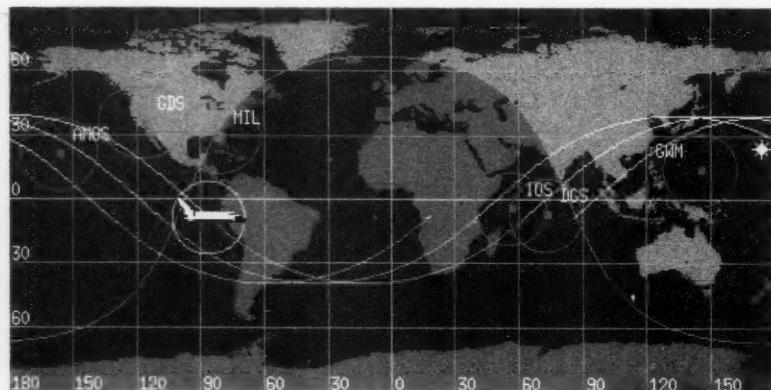


Fig. 2. A SatTrack window written by Manfred Bester DL5KR.

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user interface. These installation scripts will walk you through the installation process, asking you questions about your system. Don't worry that you will be shielded from knowing exactly what is going on during the installation—there will be plenty of time for you to explore Linux later.

Another source for information is your local bookstore. Go to the computer section and chances are you will be surprised at the number of books devoted to Linux. I counted over a dozen during a recent visit, and there are many more that can help you during installation, configuration, networking, and more.

Last, and certainly not least, the World Wide Web is a great source of information. I have included a list of key web sites to visit in the references. Of particular interest to amateur radio operators is Bruce Perens' Linux for Hams homepage, shown in **Fig. 1**.

Figs. 2 and 3 illustrate two of the many other features of interest to ham radio operators. **Fig. 2** shows one of the SatTrack windows written by Manfred Bester DL5KR. SatTrack is a satellite orbit prediction and real-time tracking program with X Window System color graphics displays. It has been written in the C language and runs on UNIX and Linux systems, using only basic X11 and X11 Toolkit functions for the graphics displays. The program not only displays in real-time where a number of satellites are, but is also capable of controlling suitable ground station equipment, like

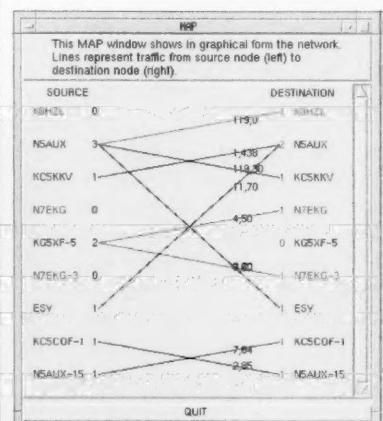


Fig. 3. A MAP window from XNET, a network analyzer designed specifically to monitor AX.25 packet radio networks.

antennas or optical telescopes, radio communications hardware or other sensors. An autotrack mode can track any number of satellites and switches automatically between them as they rise and set. Predictions of passes of satellites over specified ground stations can be run off, either interactively or in batch mode. The page is located at: <http://www.primenet.com/~bester/bts.html>.

Fig. 3 shows a window from XNET, written by Richard Parry W9IF. This is a network analyzer designed specifically to monitor AX.25 packet radio networks. It will collect and display network data, allowing the user to understand network traffic and channel utilization. XNET was written in

"Linux offers a chance to put together a TCP/IP packet network that cannot be duplicated on any other platform—the packet radio protocol is now built right into the kernel."

Tcl/Tk and provides many features that are useful to both the casual packet user and the packet radio BBS sysop wishing to better understand the network. The XNET homepage is: <http://www.qualcomm.com/~rparry/xnet.html>.

Conclusion

Almost every amateur radio operator has been asked, "What is amateur radio?" There are a variety of answers and none are incorrect. For me, amateur radio is the thrill and excitement of experimentation, with both software and hardware.

If you need to write a letter, do your taxes or develop a spreadsheet, there are computer systems that do that, and do it very well. They give you the power to be your best and concentrate on the task at hand. For software development, however, you can't beat Linux. Where else can you get the complete source code for a C++ compiler, an operating system, and the support of hundreds of thousands of users worldwide?

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Yggdrasil	http://www.yggdrasil.com	\$39.95

Table 4. Shown here is a list of popular Linux distributions. Although you can download everything on these CD-ROMs for free from the Internet, using a CD-ROM for installation is preferred. The time saved is well worth the price.

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<comp.os.linux.announce>
<comp.os.linux.answers>
<comp.os.linux.development>
<comp.os.linux.development.apps>
<comp.os.linux.development.system>
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<comp.os.linux.m68k>
<comp.os.linux.misc>
<comp.os.linux.networking>
<comp.os.linux.setup>
<comp.os.linux.x>
9. Linux general information web sites:
<http://sunsite.unc.edu/mdw/linux.html>
http://www.redhat.com/lg/gazette_toc.html
<http://www.geog.ubc.ca/sparclinux.html>
10. Linux and amateur radio web sites:
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<http://sunsite.unc.edu/mdw/HOWTO/HAM-HOWTO.html>
<http://www.Hams.com/perens/HamRadio/LinuxAndAmateurRadio.html>
<http://www.inx.de/~wahlm/>
<http://hpool0.rz.hu-berlin.de/~h0187akk/>
<http://www.qualcomm.com/~rparry/xnet.html>

Elegant Rotating—Revisited

An enhanced beam-aiming circuit.

Chet Garrison W6ZZB
3544 E. Dayton Ave.
Fresno CA 93726

A year or so ago, I was browsing through older issues of 73 and I came across an article titled "Elegant Rotating," by L. B. Cebic W4RNL (73, June 1984). His article dealt with an earlier beam-aiming circuit by K9AZG (73, November 1982), and offered some interesting improvements. The circuit is used to control CDE and similar rotor control boxes so that by setting a single potentiometer you can sit back and wait while the beam is aimed at the desired setting and stops, automatically.

I don't know why I ignored the article at that time, but when I read the article again I decided to build it for myself because my rotor was of the CDE variety.

I put the circuit together using point-to-point wiring and perfboard, and it worked beautifully! Because it was ugly, I hid it in a cabinet with a nice-looking front panel before I began using it.

Since then my oldest son has become licensed (KC6JAI). He and my friend W6BJI asked me to build an aimer circuit for each of them. One had a CDE, the other a "tail twister" rotor.

In the meantime I had obtained a computer-aided design (CAD) program so I set out to make a circuit board for the aimer, and it was successful. (It wasn't easy, but the results were very gratifying.)

Before submitting this article to 73, I contacted W4RNL and asked for permission to use information, including circuit diagrams, from his article. He replied and said OK, but also suggested I include some sort of audible device to help sightless operators, hence the little circuit added to the power supply board. Rotating the beam in CW direction produces a tone of one frequency, while rotating in the other direction produces a different tone (more about this later).

I'm very happy with the results and have since replaced the original effort with a newer, and much neater, circuit. With this circuit I can rotate my beam a full 360 degrees, stopping anywhere I want.

The circuit

I don't feel that it is necessary to go into K4RNL's article all that much. I refer anyone wanting to build this

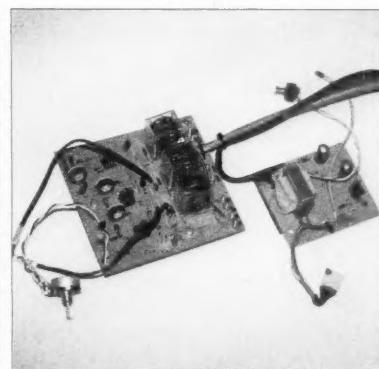


Photo B. The main aimer board and the separate power supply board.

rotator control circuit who feels the need for some theoretical information to the article in the June 1984 issue of 73.

Instead, I have only included K4RNL's circuit diagram, **Fig. 1**. Please note the following correction to his original circuit: The top normally-closed contact of K1 is *not* connected to the top normally-closed contact of K2. The upper moving contacts of both K1 and K2 are connected to terminal #2 (common).



Photo A. One of the partially-completed beam-aimers.

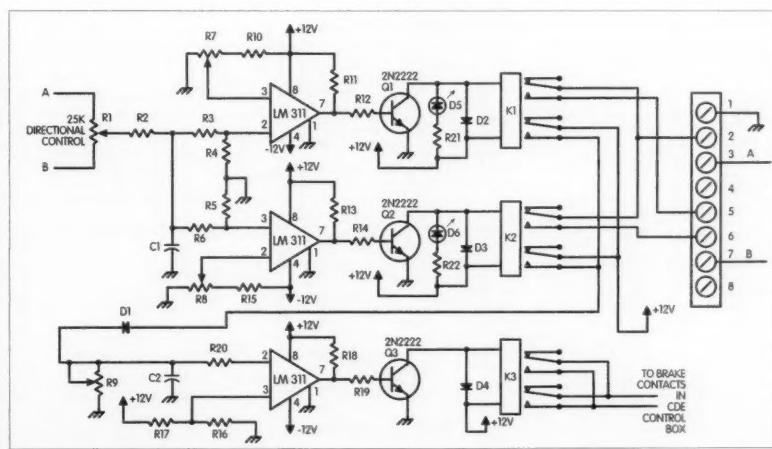


Fig. 1. K4RNL's original circuit diagram.

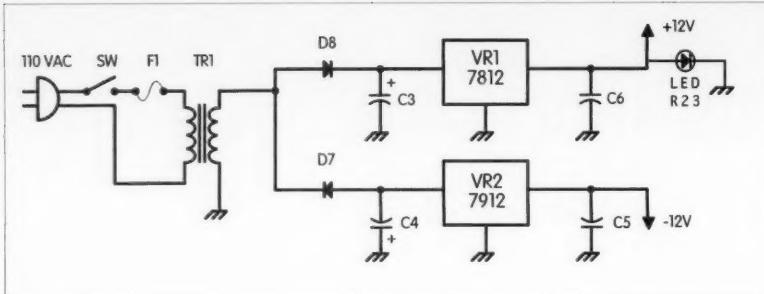


Fig. 2. K4RNL's power supply.

Fig. 2 shows K4RNL's power supply; **Fig. 3** shows the audio oscillator. There are four important potentiometers in the aimer circuit: R1, R7, R8 and R9; and two in the audio circuit: R24 and R25.

R1 is the potentiometer used to control the rotation of the rotor, while R7 and R8 are used to adjust the rotor stop points when the rotor reaches the end of rotation. They are adjusted to turn off the aimer circuit when full clockwise or counterclockwise points have been reached.

R9 is used to adjust the delay time of the brake circuit. This adjustment allows for instant to several seconds of delay before the brake is applied. This is an important feature; it allows the beam to coast to a stop before the brake is applied. A beam antenna, even a small one, can develop quite a lot of torque when stopped suddenly.

R24 and R25 are used to adjust the tones of the alarm while the beam is turning in one direction or the other—one tone for one direction and another for the opposite direction. This is an adjunct for the vision-impaired operator but can be deleted if it's not needed or desired.

The oscillator is plenty loud and, as in my case, a small speaker can be mounted inside the enclosure. A convenient spot is on the power supply board adjacent to the speaker connections. The values I have chosen in the oscillator circuit developed pleasant tones for me.

Fig. 4 shows the automatic beam-aimer circuit board (at 100% of actual size), ready for use with photocopy transfer system. **Fig. 5** is the component side of that same board, showing parts placement. **Fig. 6** shows the power supply board, and **Fig. 7** shows the component side of the board and placement of the components.

Photo A shows one of the partially completed beam-aimers. LEDs at the left and right upper corners indicate which direction the rotor is turning. At the lower left corner there will be a power switch and in the lower right corner there will be an LED "Power On"

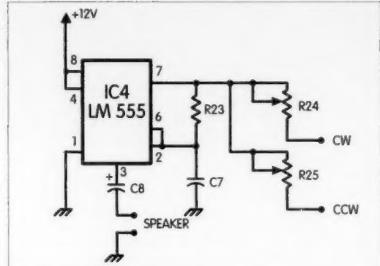


Fig. 3. K4RNL's audio oscillator.

lamp. **Photo B** shows the main aimer board and the separate power supply board. Unfortunately, the power supply board is not the one with the oscillator. **Photo C** shows how I "stacked" the two boards in order to minimize the overall dimensions of the final enclosure. The current PC board layout allows the power supply board to be stacked above the main board for better heat dissipation.

Construction suggestions

Assuming you have etched or purchased the circuit boards, check all traces to be sure there are no breaks

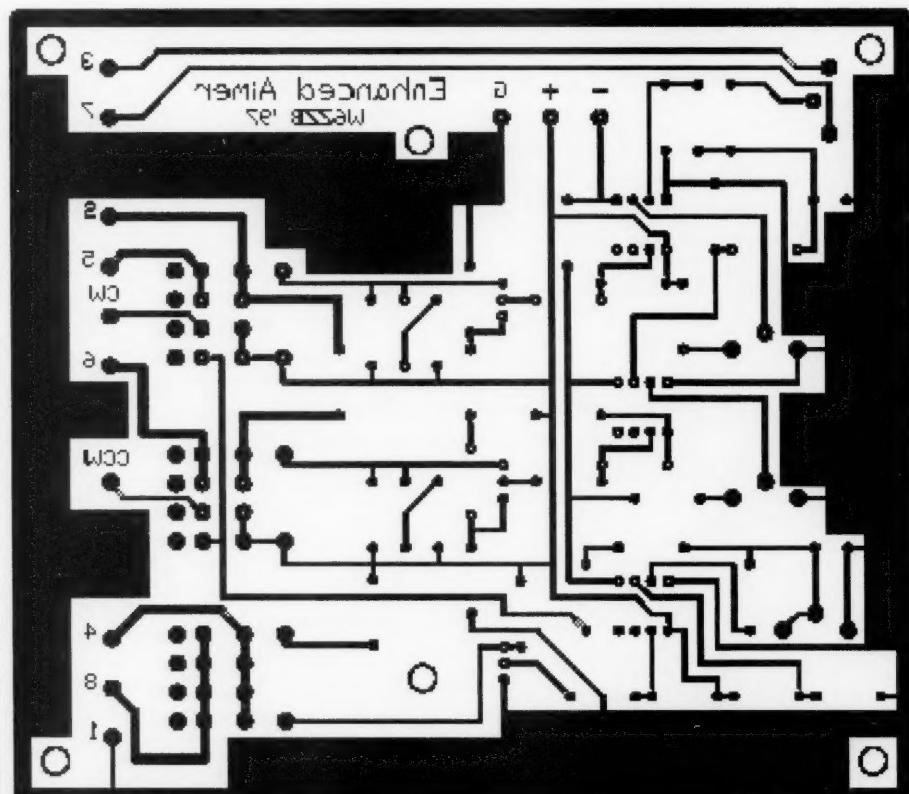


Fig. 4. Automatic beam-aimer circuit board, solder side (shown at 100% of actual size).

anywhere. Visual inspection may not be good enough so I suggest a continuity check using an ohmmeter. Assuming everything is OK, you may start installing the components.

I recommend completing the power supply board first and checking it carefully. Install a fuse holder and a fuse, the LED, the power switch and the AC cord. Plug the board into a source of AC and turn it on.

There should be ± 12 volts DC between "G" and the positive terminal, and ± 12 volts DC between "G" and the negative terminal. You can now check the oscillator by temporarily connecting a lead from the positive terminal first to the "CW" terminal, then to the "CCW" terminal, adjusting the potentiometers for a pleasing tone. Turn off the power supply and continue with the project.

In regard to the main board, I suggest strongly that IC sockets be used in all cases because if you happen to get a bad IC, it isn't easy to remove the IC without destroying the circuit board. I also suggest that these sockets, as well as the insulated jumpers, be installed first, then the rest of the components, with the relays installed last. Jumpers J1 through J9 are simply insulated wire jumpers. Check all the parts to be sure they are the right size and/or polarity.

When you have completed the installation of all the parts, connect the two boards together, with "G," "+" and "-" on the power supply board connected to similar points on the main board. Also connect "CW" and "CCW" from the power supply board to similar points on the main board.

Testing

You are now ready to do some checking. First, connect a 500 ohm potentiometer to terminals #3 and #7, with the arm of the pot connected to terminal #1. This will be your "rotor pot" for the following tests. Turn this pot fully clockwise. Also, connect a separate source of 12 to 15 volts DC, positive to terminal #3 and negative to #7.

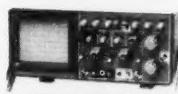
Plug the aimer to a source of AC and turn it on. If the voltages are OK, proceed with the next test.

In the event the CCW LED is on, reverse leads 3 and 7 on the rotor pot, then adjust R7 to turn off that lamp.

Now turn R1 to about midpoint; the CCW LED should light up. Now turn the rotor pot slowly counterclockwise until the CCW LED goes out. Continue

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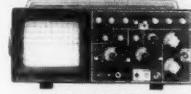
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turning the pot in the same direction and the clockwise LED should go on.

Turn both pots fully counterclockwise and adjust R8 so that the aimer circuit turns off; the CCW LED will go off. Now turn both pots fully clockwise and adjust R7 to turn the aimer circuit off and the CW LED will go off, too. Both of these adjustments will have to be repeated when you actually connect the aimer to your rotor control box.

A special note regarding the brake circuit: You must bring leads from terminals #4 and #8 to the inside of your control box and connect them to the "open" brake contacts of the direction control switch. In each of my cases I installed an eight-prong "Jones type" socket at the back of the control box, connecting all the numbered terminals to like-numbered terminals, except #4 and #8. This is the easiest method of putting it all together, believe me!

When you first rotate your new system, turn your beam to each extreme and again adjust R7 and R8 in order to turn off the aimer circuit. Also, adjust R9 for a few seconds of delay in order to allow the beam to coast to a stop.

Instead of a normal pot at R1, a 12-position switch might be installed with 2,000 ohm resistors between each contact. I tried this idea and was satisfied with the results. Now, instead of holding a switch while my beam turns I simply dial in the heading, and get back to operating!

Continued on page 69

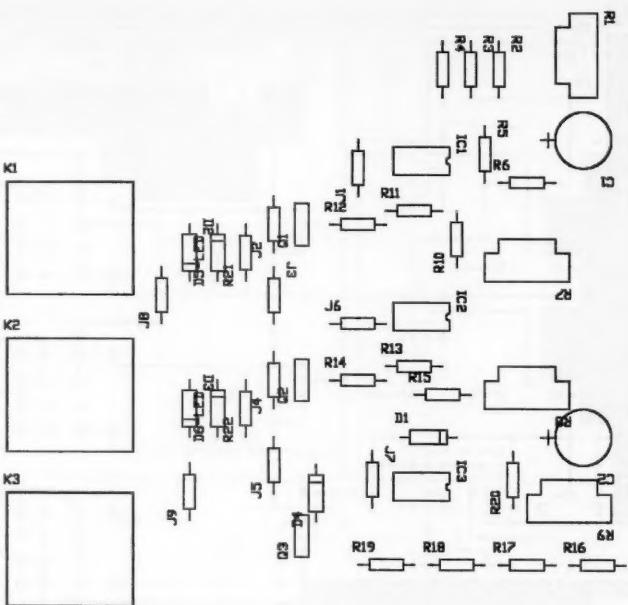


Fig. 5. Component side of the circuit board, showing parts placement (not to scale).

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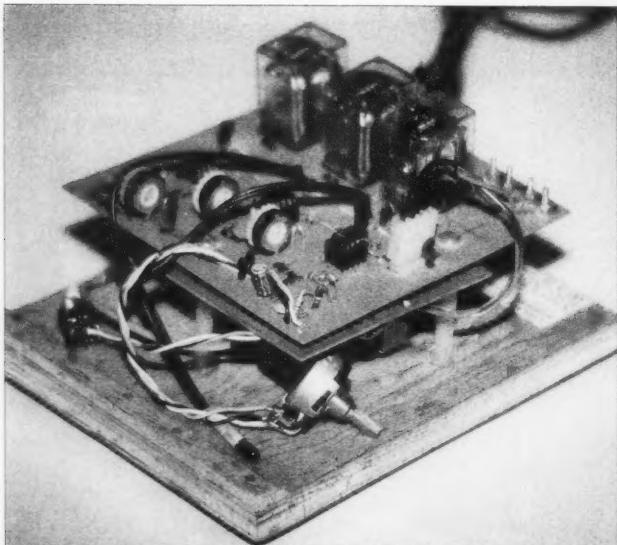


Photo C. I "stacked" the two boards in order to minimize the overall dimensions of the final enclosure.

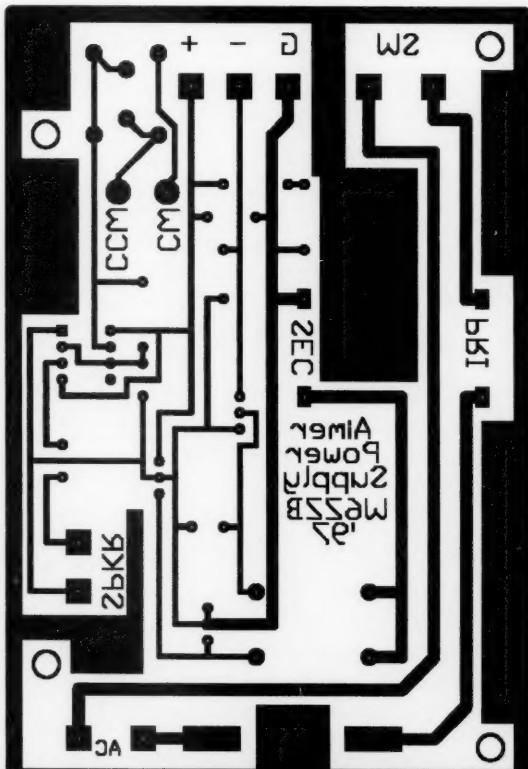


Fig. 6. Power supply circuit board (actual size).

Antenna Tuners

Do we really need them?

Robert W. Vreeland W6YBT
45 Maywood Drive
San Francisco CA 94127

Many hams use antenna tuners that are larger than their QRP rigs. Is this really necessary? While most transceivers are designed to withstand a three-to-one mismatch, this doesn't mean that they should be operated that way. I decided to find out what my MFJ-9020 would deliver to a purely resistive mismatch. It put out 3.3 watts into a 50 ohm load and 3.2 watts into 25 ohms. Not bad! The output dropped to 2.8 watts for 82 ohms, 2.6 watts for 100 ohms and a paltry 2.1 watts with a 135 ohm load. Apparently the MFJ-9020 prefers loads of 50 ohms or less.

Fortunately, most portable antennas will have an impedance in this range. According to Terman a half-wave horizontal dipole must be hung at a height of more than 1/7th of a wavelength in order to have an impedance greater than 50 ohms.¹ What

a lucky break for 40 meter QRP fans! Can you hang a 40 meter dipole higher than 20 feet when you are out in the boonies with only trees for supports?

Circuits to try

So far we have only talked about purely resistive loads. What about that nasty thing called reactance? Most antennas have it and it really should be tuned out, which can be done by carefully adjusting the antenna length (usually not practical). An easier way is to insert either a capacitor or an inductor in series with the antenna to cancel its reactance. But how do you know whether you need a capacitor or an inductor? Usually you don't. The answer is to use the circuit shown in Fig. 1a. It is useful for fine-tuning antennas which are near resonance. At resonance, the inductive reactance is equal to the capacitive reactance and cancels it, leaving zero. At lower frequencies the circuit becomes a capacitor and at higher frequencies it is an inductor. This is a practical circuit. It can be made from a small plastic dielectric broadcast tuning capacitor (Calectro A1-233) and a toroidal coil. It is great for canceling the reactance of antennas with a radiation resistance near 50 ohms, such as a quarter-wave or a half-wave dipole. The circuit is not, however, an impedance transformer.

If we add just one more miniature 365 pF variable, we can build an impedance-transforming T network (Fig. 1b). It will give you a perfect match. This network is the smaller unit shown

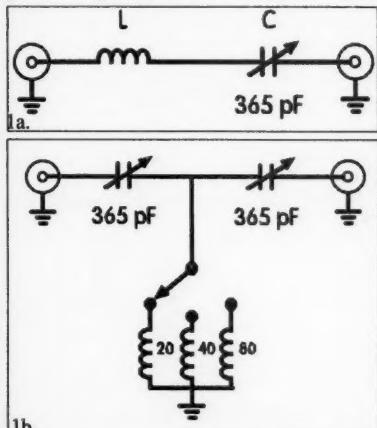


Fig. 1. Miniature plastic dielectric variable capacitors can be used in extremely compact QRP antenna tuners. The circuit shown in Fig. 1a is useful for fine-tuning antennas that are close to resonance. For a wider range of matching use Fig. 1b.

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at the top of **Photo A**. I used pin jacks instead of UHF connectors for the input and output. When used with my MFJ-9020 it matched 25, 50 or 100 ohms without any measurable loss. However, when I tried it with 18 watts and a 50 ohm load, I lost a watt. Better stick with QRP or the plastic dielectric in the capacitors might melt!

With my 27 watt MOSFET rig I use the circuit shown in **Fig. 2**.² The capacitors were borrowed from an MFJ tuner. Band changing is done with a jumper on a double banana plug. It grounds either the 20 or the 40 meter coil. On 80, the 40 and 80 meter coils are connected in series. To complete the unit, I added a VSWR meter using the directional coupler from a burned-out meter. The complete tuner measures only 5-7/8" by 3-1/8" by 3", and weighs just 1.25 pounds.

You may wonder why I chose toroidal coils rather than the higher Q air core ones commonly found in antenna tuners. Well, my home-brew tuner and the MFJ-900 both put out 26 watts into a 50 ohm load. However, for a 25 ohm or a 100 ohm load, the home-brew tuner was the winner by a watt or two. The toroidal cores are available from Amidon.

Oh, one other thing. How come manufacturers persist in packaging their standing-wave meters in massive plastic cases or even heavier steel ones? You can easily build your own and it will weigh less than half a pound. Two examples are shown at the bottom of **Photo A**. On the left is a toroidal transformer bridge (*ARRL Antenna Book*).

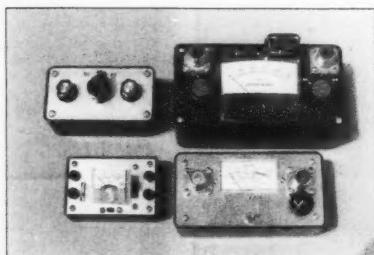


Photo A. Very compact antenna tuners can be built using toroidal coils and miniature capacitors. The larger unit is used with my 27 watt MOSFET amplifier. At the bottom are two types of standing-wave meters.

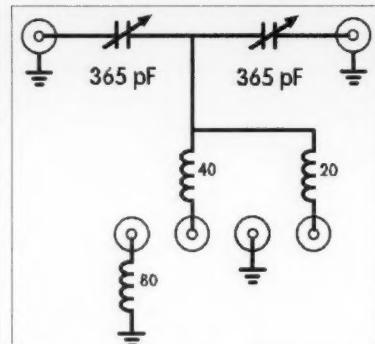


Fig. 2. This medium power antenna tuner utilizes air dielectric capacitors. A shorted double banana plug is inserted into jacks connecting coils for the desired band.

This type of VSWR meter can be very compact. They are, however, a bit tricky to build and adjust. Most commercial tuners use a three-wire shielded transmission line as a directional coupler. Some use three silver-plated rods suspended in a metal trough. Others use three parallel traces on a circuit board. I built the one shown in **Fig. 3** and **Photos A** and **B** using a 6-1/2" length of RG-58 A/U. First I removed the outer plastic jacket. I then opened up the braid a little bit. Next I threaded two lengths of #22 tinned bus wire into Teflon™ spaghetti. I then threaded the insulated wires inside the braid, trying to keep them on opposite sides of the center conductor. The circuit is shown in **Fig. 3**. Be careful to keep the leads to the 1N67A diodes and the 150 ohm resistors very short, as shown in **Photo B**. If you can't find 1N67A diodes, use 1N34A. The RG-58 A/U braid should, of course, be grounded at both ends. I borrowed the calibrated meter from a discarded Radio Shack™ standing-wave meter. If carefully constructed, the result should be a perfectly balanced VSWR meter. It should need no adjustment.

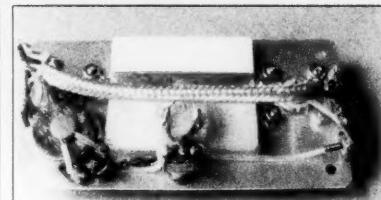


Photo B. A modified length of RG-58 A/U makes an ideal directional coupler. If carefully constructed with short leads, no adjustment will be required for a perfect balance.

While not absolutely essential, an antenna tuner can be a useful addition to any portable station, especially when less than ideal antennas must be used. This does not mean, however, that the tuner must be a gigantic box. Careful construction can result in a handy compact tuner, and a lightweight standing-wave meter.

References:

1. Terman, F.E., *Radio Engineer's Handbook*, McGraw-Hill, 1943 (curve, page 791).
2. Vreeland, R.W., "Transformerless Amplifier," *73 Amateur Radio Today*, August 1995, pages 48-54.

Parts Sources:

Calectro, GC Electronics Division of Hydrometals, Rockford, Illinois 61101.

Amidon Associates, 10233 Otsego St., North Hollywood CA 91607

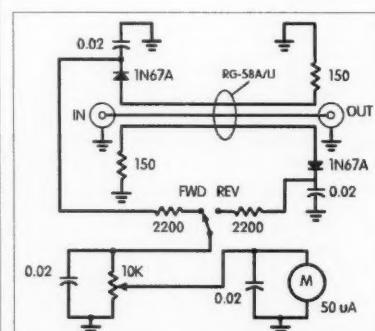


Fig. 3. A simple standing-wave meter using an RG-58 A/U directional coupler. The 2200 ohm resistors are RF filters. They also help protect the meter against burnout at maximum sensitivity.

Toroid Winding Instructions (all cores from Amidon)		
Band	QRP Tuner (Fig. 1b)	Medium Power Tuner (Fig. 2)
80m	22T #20 on T106-6 Core	18T #20 on T106-6 Core
40m	18T #20 on T68-6 Core	19T #20 on T68-6 Core
20m	10T #20 on T50-6 Core	10T #20 on T50-6 Core

The Topbander

A cheap and easy antenna tuner for 160 meters.

Kenneth Lowrey W8ND
7716 Oceola Lane
West Chester OH 45069

With the current sunspot cycle seriously affecting operations on the high frequencies, the 160 meter band presents some attractive wintertime operating alternatives. It is not plagued with QRM from foreign broadcast stations like 40 meters. The "top band" is not crowded like 75 meters and the operators are more friendly and more accommodating than some of the groups on 75 meters. Some have called 160 the "gentleman's band."

For many years I was under the impression that successful operation on 160 meters required long lengths of wire at high altitudes and miles of radials. However, not many of us can erect a dipole antenna that is 260 feet long—not many of us own the large area of land required for an extensive radial system. The good news is that we can still get in on the fun and action on 160 because none of this special stuff is essential on 160 meters! Granted, if you want to work DX regularly on the top band you would be advised to erect large antenna systems with as much height as possible. You will want to experiment with special receiving antennas, and be sure to include the best radial and ground system possible. However, routine operations such as rag-chewing and meeting your friends on 160 can be very rewarding without going to extremes on the antenna and radial systems. In fact, you can have loads of fun on 160 with just a small amount of effort.

The secret of my successful 160 operation, and the object of this article, is a home-brew antenna tuner which I call "The Topbander." I have worked stations over thousands of miles away with excellent results while running only 100 watts of power into a 75 meter dipole. I

even made a contact with a QRPer who was running only 10 watts on SSB! QRP on 160? Yes, fun activities on 160 await you. All you need is a length of wire (it does not have to be a dipole) and The Topbander. The Topbander described in this article can be assembled in just a few hours. An added benefit is that this project is very kind to the wallet!

Construction

This antenna tuner is different from any other that I have seen because it uses no variable capacitors. The capacitors are fixed, and the inductance is variable. There are several reasons for not using variable capacitors. Variable capacitors for frequencies like 160 meters are large, difficult to find, and usually expensive. Large variable capacitors at these frequencies mean a lot of big plates, which require a lot of chassis space and take up a sizable part of the operating area as well. In addition, if you wish to operate with high power, even wider plate spacing is required to eliminate arcing during transmissions; this compounds the size problem. Furthermore, a large

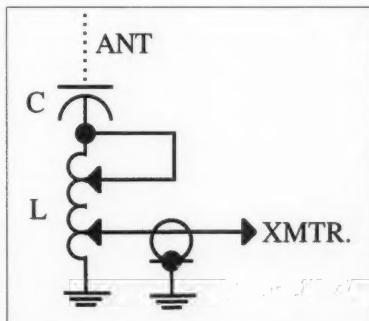


Fig. 1. The schematic diagram of the tuner is a simple series circuit.

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The 10 meter test had started, and I expected the band to open about the time I arrived at the motel. Rig and gel cell were in the trunk, Maxi-J was right beside, rolled up inside the launcher pail. Room with a view. Maxi takes off from the balcony sloping down to a tree. His tail slips under the door. And I'm 59 in Japan. Info

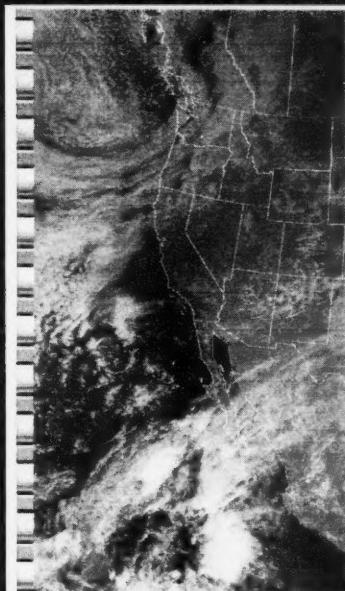
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antenna tuner looks out of place in today's high-tech, small-size-equipment operating environments. By using inexpensive fixed value capacitors you can eliminate the high cost of variables and build a tuner which is capable of high power operation but is still small in size. My finished tuner is mounted on a piece of wood and measures only 6" wide x 5" deep x 8" tall!

Fig. 1 shows the schematic for the tuner. Talk about simplicity! The components are a home-brew coil and a capacitor bank consisting of a series-parallel network. Start construction of the tuner by winding the coil.

My coil consisted of 40 turns of insulated wire. I used #14 solid copper wire, which is normally used for house wiring. The wire is close-wound, using the insulation as a spacer between turns. Yes, we have been told that power could be lost to the insulation due to coil heating, but this is more theoretical than actual; my coil shows no signs of running warm even after 30 seconds of keydown at 800 watts.

This tuner is designed for a 75 meter dipole with a feedline shorter than 65 feet in length. I have been operating on 160 for some time now with nothing more than a 75 meter inverted vee which is about 45 feet high at the center. In fact, one end is only 12 feet off the ground and the other is only about 18 feet high. The vee is a balanced antenna, fed with 450 ohm ladderline and works all bands from 80 to 10 meters. However, for 160, I short the ends of the ladderline together in the shack and feed the antenna as a longwire. If you have a coax-fed antenna, you can connect the center conductor and shield together and feed it as a longwire. If you use other than a 75 meter dipole, or your feedline is longer than 65 feet, you may need to tap your coil at different turns. In fact, you may have to change the tuner from a series arrangement (**Fig. 1**) to a parallel arrangement (**Fig. 4**) to get a low SWR. In either arrangement, the tuner is still very simple.

My experience has shown that the tap settings may change as the weather changes. Now, do not run to tell your friends that you can predict the weather from reading coil taps! The reason that the coil settings change with the weather is that the 75 meter dipole antenna is electrically short at this frequency. With

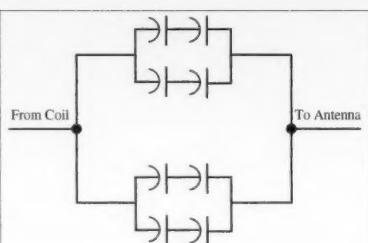


Fig. 2. The capacitor bank is a series-parallel network of 470 pF capacitors; total capacitance equals 940 pF.

electrically short antennas, the higher the ground resistance, the more power is lost. Resistance in soil varies considerably due to changes in soil moisture and temperatures. As a result, variations in the soil conductivity around your ground system affect the number of coil turns needed for a resonant circuit at your location, and the placement of coil taps. So, even slight changes in ground resistance will affect the tuning circuit, such as after a rain or snowfall; the tap positions will also have to be changed as the soil dries during prolonged periods of drought. After a short period of operating under different weather conditions, you will discover where your coil taps should be placed to obtain the lowest SWR. The SWR does not have to be 1:1 to obtain power output. An SWR of 1.2 or even 1.5 may result in full output on 160.

Making the coils

To construct your coil, first cut an 8"-long piece of 2" schedule 40 PVC plastic pipe (note that 2" plastic pipe is the inside diameter; your coil form will be about 2-3/8" outside diameter). Then drill a small diameter hole about 1/2" from each end. Insert a small screw into each hole and slip on an eye-type connector before tightening the connection with a nut. Solder a length of # 14 solid copper wire into one of the eye hooks. Next, wind the wire on the coil form, and solder the other end of the coil to the hook on to the other end of the coil form. The coil should be tight against the coil form, but it may not be as tight as a factory-made coil, and a little "play" is acceptable. I found strips of duct tape to be useful in holding the coil in place during the winding and soldering process.

Several taps will probably be required on your coil. I had to start my taps at five

turns from the ground end, and at three turns from the output end. Cutting coil taps in the wire insulation is easy; the secret is to take your time and try not to cut or nick the wire. I used a hobby-type knife to remove the wire insulation for the taps. Make certain that your blade is sharp, and make your cuts *very carefully*. Most hobby knives are very sharp, and you can cut yourself easily. Remember that this is amateur radio, and safety is our first concern.

Place the coil in a vise in a horizontal position, taking care not to crimp or damage the wire. Choose a coil tap point and make a vertical cut along one side of the wire, again trying not to cut or nick the wire. I made my tap cuts about 3/4" in length. At the top and bottom of your vertical cut make horizontal cuts across the insulation to expose the bare copper wire. It is advisable to "stagger" the taps so as not to interfere with adjacent tap points. I used small alligator clips to test the SWR, and when I found the tap positions which gave me the lowest SWR, I connected permanent coil taps. To do this, I used pliers to curl the end of a ring or eye connector, placed it around the bare wire, then crimped and soldered the connector to the wire. Be careful not to solder to the adjacent coil turns. Once the placement for the permanent taps were determined, you can make a new coil by unrolling the old one and using it as a pattern to determine the tap locations on the new wire. This is easily done if you place one end of both

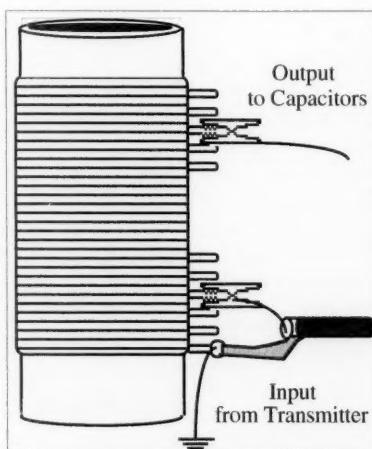


Fig. 3. Wiring the tuner is easy. Simply connect one alligator clip from the transmitter to the coil, and another clip from the coil to the capacitor bank.

wires in a vice. You may decide, as I did, to use your prototype coil as your permanent one. This is OK too, if you did not nick the wire when removing the insulation. Remember that ground resistance changes with soil temperature and moisture content; make a number of QSOs over several weeks with your Topbander under different weather conditions so that you will know how many permanent taps you will need and where these taps should be placed on your coil.

You may choose to purchase coil stock instead of winding your own coil. A good choice would be an 8"-long coil with a 2-1/2" diameter, and six turns per inch.

The capacitor network

Next, build the capacitor network. Note that the capacitors are in a series-parallel network (Fig. 2). If you wish, you may substitute other capacitor values in your series-parallel network. If your capacitor values are different, then the number of coil turns required for resonance will also change. The formula for calculating series and parallel capacitance is found in all of the amateur handbooks and in most electronics textbooks. However, if you use the same schematic as Fig. 2, and all of your capacitors are of the same value, the total capacitance of your network will be *twice* the value of *one* capacitor in your bank. I used 470 pF capacitors and the total value in my bank of capacitors is 940 pF. Also, you do not need low tolerance capacitors; 20% tolerance is fine. If you have precision-value capacitors in your junk box go ahead and use them if you like, but they are not required for the success of the project.

You will need high-voltage fixed-value capacitors for this tuner. I used 3 kV capacitors in my circuit. My capacitor bank will take 800 watts of power at keydown for over 30 seconds without heating. Mica transmitting capacitors are probably the best choice for this application, but I used disc capacitors because that is what I had in my junk box. I used NPO disc ceramics to keep heat from affecting capacitance values, but NPOs are not required.

If you do not have any high-voltage capacitors in your junk box, there are several sources for them. You could cannibalize an older tube-type television

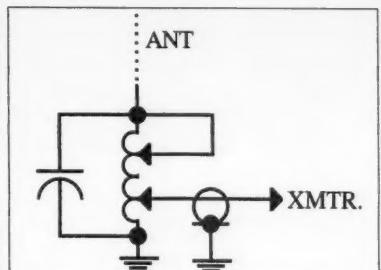


Fig. 4. An alternative diagram for antenna systems with feedlines longer than 65 feet.

chassis. Another source would be the flea market vendors at hamfests. If these efforts are not successful, ask around on the 2 meter repeaters or at your club meetings; sometimes other hams have transmitting-type capacitors in their junk box just waiting to be used. A fourth alternative would be to purchase the required capacitors from a retail vendor; they are usually not expensive. Some surplus dealers sell high-voltage transmitting capacitors. (Radio Shack™ stores generally do not stock high-voltage capacitors.). If all else fails, send me an SASE and I will help you locate the necessary parts.

I built my capacitor bank on a small piece of perforated board which measured about 2-1/2" square. In order to save space, I mounted both the perforated board holding the capacitor bank and the coil vertically on a piece of wood.

The wiring

The wiring of the tuner is very simple. Simply run a short piece of coax from the transceiver to the tuner and connect the center conductor to an alligator clip for the input coil tap (Fig. 1). Attach the coax shield and your earth ground to the low end of the coil. Then use another alligator clip for the other tap and connect it to the capacitor bank (Fig. 3).

Connect the output from the capacitor bank to the antenna, and feed it as a longwire. If you have a feedline longer than 65 feet, connect the capacitor bank *across* the coil (Fig. 4). Adjust the taps for the lowest SWR and you are in business with The Topbander!

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S8-3	42 x 19 x 1.0	9.35	11.25
S8-4	63 x 19 x 1.0	14.00	12.50
S8-5	6.4 x 27 x 1.1	8.75	5.50
S8-6	4.8 x 27 x 1.1	12.00	14.25
S8-7	6.4 x 27 x 1.1	13.75	16.25
S8-8	2.6 x 27 x 1.1	7.25	8.75
S8-9	3.2 x 27 x 1.1	8.50	10.00
S8-10	4.8 x 27 x 1.1	9.25	11.00
S8-11	5.3 x 27 x 1.1	11.25	13.25

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CIRCLE 167 ON READER SERVICE CARD

Build the Turbo Digi-Sniffer

A quick, cheap and easy digital field-strength meter.

Dave Pelaez AH2AR/5
7309 Centenary Dr.
Rowlett TX 75088

Whether you are involved in foxhunting, testing actual antenna performance or "sniffing out" leaky transmission lines, a sensitive field-strength meter (FSM) is an excellent addition to the ham shack.

The heart of this digital FSM utilizes an already-assembled liquid crystal digital display that has become available through numerous sources/distributors. I initially found one of these displays at the Dallas hamfest. Originally, the reason for buying the display was to use it in another application as a digital frequency readout for an amateur television downconverter. However, once I examined the display, I immediately recognized its potential use as a digital FSM. I returned to the hamfest the following day to get the name of the distributor,

and much to my disappointment, couldn't find the guy who had been selling them—he must have packed up early.

Several months later I was in the Dayton, Ohio, area, and rediscovered another source for these displays: Midwest Surplus Electronics. I checked with the store owner and he verified that he had a reliable source for these displays, and Midwest Surplus also had all of the parts called for in this "Turbo Digi-Sniffer" article. (See the toll-free number and address at the end of the Parts List.)

The display

Described as a 3-1/2-digit LCD panel meter, the display is manufactured in Korea. The model number is listed

as "PM-128." The panel meter comes already assembled and uses a dual-slope integration analog-to-digital converter circuit. It has a sample rate of three readings every second. The maximum voltage that can be measured with this display is 500 volts; this can be done by simply changing the value of two resistors. The display can be set up to read at the microvolt level so it can become the main building block for a digital field-strength meter.

Construction: digital panel meter modifications

The panel meter circuit board's silk-screened pads show a pair of pads marked "RA" and "RB" (see Photo B). The 1 megohm potentiometer that will

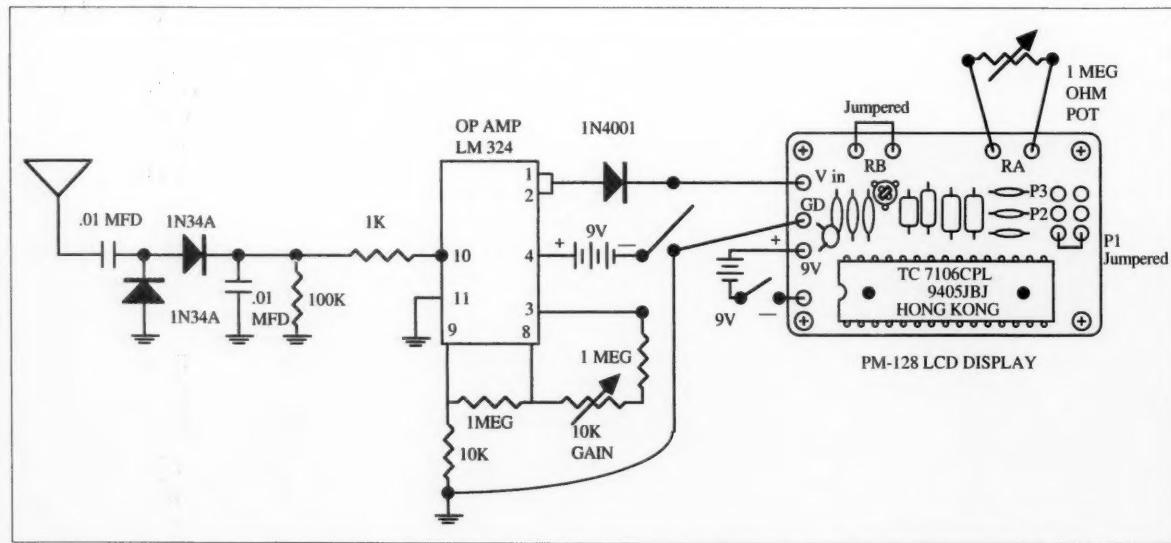


Fig. 1. Schematic for the Turbo Digi-Sniffer. When using this circuit with the LCD display, the display and this circuit must have separate 9 volt power sources.

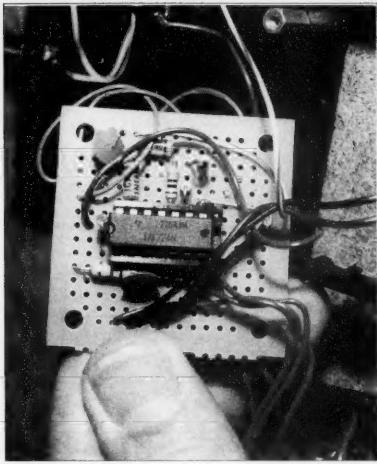


Photo A. The op-amp voltage multiplier circuit used in the Turbo Digi-Sniffer. Point-to-point soldering using perf board was the selected method of construction. Lead length is not critical.

be accessible from the front of the Turbo Digi-Sniffer should be connected to the junctions at RA. The potentiometer will now allow you to change the displayed voltage sensitivity. The junction pads at RB should remain jumpered together. The two P1 junctions also need to be jumpered together. The P1 modification sets the decimal point on the display as (.000).

Construction: the rectifier/voltage multiplier circuit

The rectifier/voltage multiplier circuit portion of this project has appeared in many electronic "recipe books." Aside from containing a passive rectifier circuit, it also contains an operational amplifier (LM 324) which is employed

as a voltage multiplier. When coupled with a digital voltage display sensitive to microvolts, the display will be able to essentially detect voltage in the picovolt (billionth of a volt) range. This particular project will require two 9 volt batteries. As the op amp section is an active circuit design, it will require a 9 volt power source. The LCD display will also require an additional and separate 9 volt battery. Both of these batteries are connected through the DPDT switch. The LCD panel display pulls less than a milliamp of current, and because of this low current drain on the battery the display battery will last a year or more with normal use.

I elected to mount the rectifier/voltage multiplier circuit on some perfboard and point-to-point soldered this circuitry, populating the board by surrounding the 14-pin IC socket with the listed components. The actual circuit layout is noncritical, and the mount-and-solder method of placing the circuit components on the perfboard does not have to follow any particular order as long as it follows the schematic layout. Since I had a number of different types of antennas configured with a BNC, I chose to use one of the junque box chassis-mount BNC connectors I had. A UHF-style connector or even an RCA-style chassis mount connector would work fine as a way to connect an antenna to the Turbo Digi-Sniffer.

Once the rectifier/voltage multiplier circuit is complete, connect it to the digital display board. As a matter of interest, you can keep the cost of the project down by using junque box parts. Any germanium diodes will work (some may

work better than others). The value of the RF choke and the capacitor also are not critical within the rectifier circuit. The aluminum chassis pictured was purchased at Midwest Surplus for \$1.95. The Turbo Digi-Sniffer acted a little erratically when originally built into a plastic enclosure, possibly due to capacitive coupling with the hand and the tendency for RF to take other paths past the diode and choke. An aluminum chassis will rectify this situation. The most difficult part of this project was "hogging out" the window on the aluminum chassis for the digital display. The most time spent on this project was in preparing the chassis. It took less than an hour to solder the components and leads in place!

The smoke test

For initial alignment, the panel meter has to be on and you will need access to the 10k trimmer and the 10 megohm chassis-mounted potentiometer. You may need to go back and forth between the trimmer pot and the chassis-mounted pot to get the initial alignment in the ballpark. Try starting with a rubber-duck-sized antenna on the Turbo Digi-Sniffer and an RF source, such as a signal generator. Without a signal generator you could use an off-hook cordless phone or baby monitor. If the field is too strong for the counter to resolve or if the gain control on pins 8 and 3 of the LM 324 is too high, the display will go into an over-range condition, displaying the number 1, with no other digits. The chassis-mounted 1 megohm potentiometer controls the sensitivity of the LCD display, while the 10k trimmer controls the gain level of the voltage multiplier circuit. With the gain all the way up on the potentiometer, you will see that you will be able to adjust the 10k trimmer at the LM 324 to a level where there is a zero reading with no antenna connected to the Turbo Digi-Sniffer (with no nearby RF sources), but with an antenna connected the display will start detecting "far-off" RF sources. Be aware that these far-off sources may be a local AM or FM radio station, and the LM 324's gain control can attenuate these very weak signals. After proper adjustment, the display should read .000 with no RF field present. A nearby RF field will cause the display to show digits; the stronger the field, the higher the number displayed.

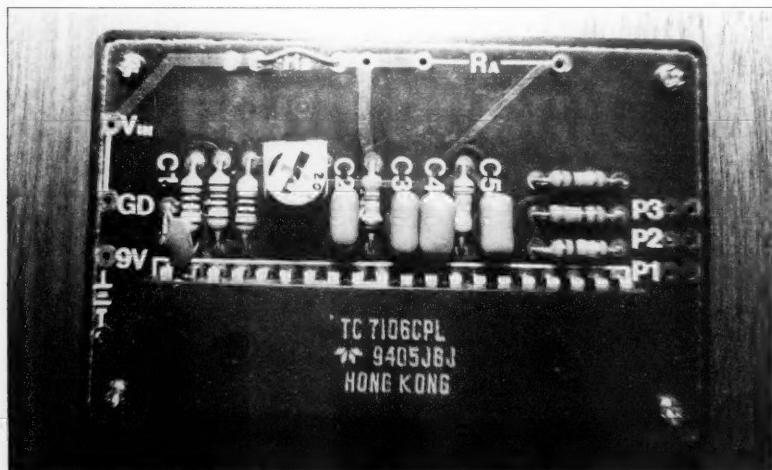


Photo B. Back of the LCD display, showing the silk-screened layout pads for the described hookup.



Photo C. Pre-built LCD with analog-to-digital converter.

Let's experiment

I've found that the Turbo Digi-Sniffer is sensitive throughout a wide range of frequencies. Also, keep in mind that different types of antennas on the Turbo Digi-Sniffer will also affect sensitivity at different frequencies. As this device is not calibrated, the emphasis should be placed on "relative" (in relative field-strength readings). Relative readings are extremely useful when checking out antennas or when out in the field sniffing for foxhunt transmitters. Do you want a really big scare? Try checking out your microwave oven using the Turbo Digi-Sniffer. Yes, Virginia, microwave ovens do leak!

When using the Digital FSM to detect RF fields, insure that the measurements are conducted at least two wavelengths from the transmitter antenna. Also

remember to keep the Turbo Digi-Sniffer's antenna at the same orientation (polarization) as the transmitter antenna. Note that the metal chassis and the Turbo Digi-Sniffer antenna, if brought into an optimum plane, can become coupled with the transmitter antenna and become a part of the radiating system.



Photo D. The completed Turbo Digi-Sniffer.

Talk about some wild field-strength readings!

A perfect club project?

The cost of all the parts of this project can be kept at about \$20 with careful shopping, and the Turbo Digi-Sniffer design is both simple and practical. What's stopping you, then, from organizing a club project one Saturday morning and putting together a barrelful of these useful test instruments for all the club members? **73**

Wanted!

Ham related
cover pictures.
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Parts List

Qty.	Part #	Description
1	29-01	LCD panel display
1		1 megohm potentiometer (chassis-mount)
1	4" x 2" x 2-3/4"	Aluminum chassis
1	RF-114	BNC female chassis mount
1	LM-324	Quad op amp
1	1N4001	Diode
2	1N34A (or equiv.)	Germanium diode
2	CD111	.01 μ F disc cap
1		1k ohm 1/4 watt resistor
1		10k ohm 1/4 watt resistor
1		100k ohm 1/4 watt resistor
2		1 megohm 1/4 watt resistor
1	VR207	10k ohm single-turn trimmer pot
1	ICS2	14-pin IC socket
1	570-21	Mini chassis-mount DPDT toggle switch*
1	JALPC-1	Perf board (you cut to size)
2		9V battery connectors

Note: All parts can be ordered from Midwest Surplus Electronics, P.O. Box 607, 501 W. Main St., Fairborn OH 45324; (800) 523-3690.

* DPDT chassis-mounted switches are available at Midwest surplus, so they are used here in lieu of the DPST (double-pole single-throw) switch used to switch on and off the two 9 volt batteries. The double-throw portion of this switch is not used for this project.

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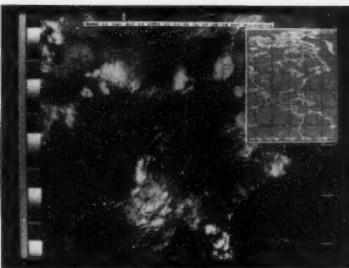
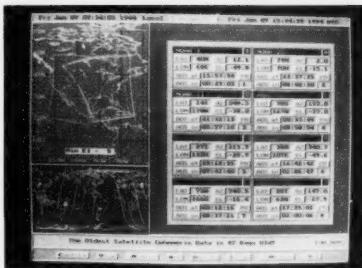
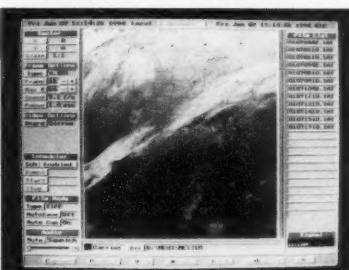
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CIRCLE 257 ON READER SERVICE CARD

Sumas Mountain High

Building a self-sufficient repeater tower on a British Columbia mountain.

Will Imanse VE7BID
211-33370 Nelson Ave.
Abbotsford BC
Canada V2S-2L8

In the center of the 80-mile-long Fraser Valley in British Columbia, Canada, sits 3,000-foot-high Sumas Mountain. This hill is situated perfectly to give a clear, unobstructed view that stretches (from west to east) from the east coast of Vancouver Island almost all the way to the town of Hope, and southward into the United States to well past the city of Bellingham, Washington.

Several years ago the hams of Abbotsford BC, at the base of the mountain, dreamed of putting a repeater on Sumas. Our dream has finally become a reality.

We chose a site on a ridge at 2,750 feet. The Fraser Valley Amateur Radio Emergency Services Society applied for a government lease and was approved. Next came the challenge: Building and running a repeater site with no available power in the foreseeable future and very limited vehicle access.

The designers decided to use solar power; later we added wind power. The British Columbia Telephone Company donated a 50-foot tower in return for a small donation to the Telephone Pioneers of America Society. A donation of cinder building blocks from the local Blackwood Building Supply and Home Hardware store helped, too. One of the local hams, an experienced bricklayer, was put in charge of constructing the building. Another ham with cement experience (and a truck for the job), took care of the cement work and getting the materials to the site. The tower work was done by a ham who worked in the tower construction field. Teamwork and



Photo A. Storms are common up here, so the guys are heavy-duty.

cooperation from a number of other hams helped create a professional-looking site. A small solar-powered commercial site not too far from ours looked amateur by comparison!

We erected the 50-foot tower next. We drilled down into the stony mountainside three feet in four places for the base and epoxied threaded steel rods into the rock. The tower was then put into position, with a 20-foot-diameter H fixture installed at the top for the antennas. The vertical pipes at the end of the H fixture were extended above and below for both upper antenna and lower inverted antenna mounting. This allowed for eight antennas to be mounted on the tower without having to mount them on the face of the tower itself. We also added an anti-climb shield and gate to keep unauthorized visitors off the tower.

The tower was supposed to be self-supporting, but with the amount of weight at the top we decided to add guys. As you can surmise from **Photo A**, the mountaintop winds can be fierce.

Next, we added a donated chain link fence, then a second tower—an 80-foot guyed tower, donated by the local Rogers Cablevision outlet. It was also installed with two H fixtures, providing room for six more antennas. With some more small donations to the Telephone Pioneers, we obtained some antennas and heliax waveguide.

The main VHF repeater is on 146.60 MHz and the UHF repeater is on 442.025 MHz. We also have a packet repeater, a full duplex UHF link for phone patches to Abbotsford, and a 1.2 GHz FM amateur television repeater with two remotely-controlled cameras, mounted on the two towers. These cameras can be tilted and panned by tone control. They allow us to check conditions and monitor any intrusions at the site. They also allow fantastic views up and down the valley. An outside speaker and microphone can be activated remotely to communicate with people at the site. A planned motion detector with announcement on the VHF

repeater will also alert us to any intruders.

All the equipment runs from 16 solar panels at the site. Eight are located on the roof of the building; the other eight are on one tower. The panels on the tower can be for winter and summer sun angles.

We've tried a number of windmills, but so far four of them have self-destructed. The first, a 75 watt model, lasted a few months. The next three were 300 watt models. One lasted less than a day, and another less than a week—and that after the manufacturer assured us that they were almost indestructible. The current 300 watt model is still running—we're keeping our fingers crossed.

At the same time, we also put up a 55-foot self-supporting tower in the town of Hope, 50 miles to the east. A VHF repeater at 147.08 MHz was installed in a cabinet on the side of the tower. Now we're working to link the Abbotsford and Hope repeaters, and then expand farther east via links into British Columbia's interior.

We're proud to have built such an impressive repeater site. Our group has solicited all the donations to the cause, and in some cases donated our own equipment and funds. The cooperation among the group of amateurs that took on this project was first rate. There was seldom a problem securing volunteers for a work project. *This* is what amateur radio is all about. **73**

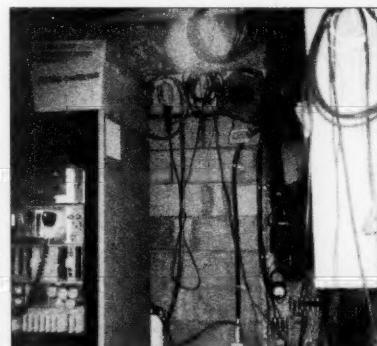


Photo B. Keeping some spare cables and other items on hand helps. The main and secondary 2m repeaters are visible on the left.

NEVER SAY DIE

Continued from page 4

third the cost. With the number of government employees now outnumbering our manufacturing force, it does tend to make everything we let the government buy for us cost at least three times normal. And that's on a good day.

If Congress would allow competition, we'd have private mail services providing two deliveries a day, with first class mail for 10¢, according to expert estimates. If you'd like to get really upset over our mail service, read *Monopoly Mail* by Douglas Adie, Transaction Publishers, Rutgers University, New Brunswick NJ 08903, ISBN 0-88738-747-0, 197p.

As long as you're content to work the first four hours of every day for the government and the rest of the day for yourself, the situation is just going to get worse. Yes, the government comes first. They get your money without your ever even seeing it.

What can you do about the mess? Well, I've already explained that. Let me boil it down for you. 1. Never re-elect anyone. Keep flushing the political toilet. And don't re-elect anyone ever again in the future. We don't need to worry about term limits if you'll flush the toilet every two years. 2. Let's get some hams into our state legislatures.

Justice

A letter from a reader mentioned that the medical industry scams are at least matched by our criminal justice system. I love the euphemism. Justice system, indeed. And how about our "correctional facilities"? That's about the last thing they do. Anyway, Leigh writes, "They don't care who's guilty, they just need convictions, and they need to keep the minorities stirred up just for job security. They will gladly send an innocent person to prison to further their careers. I'm told that Sandra Day O'Connor made it to the Supreme Court on cases where the evidence was manufactured by a crooked lab that used to operate in Phoenix. After their methods were discovered they closed shop and moved their business to Texas, but very few cases were retried as a result."

Surely Leigh must be exaggerating. No American would ever do anything like that, would they? For some reason that reminds me of when I was a TV producer-director and I got to know a New York City police detective who wanted to blow the whistle on what was going on. For instance, he told me about a cooperative dentist just down the street from the station house where they'd take prisoners. The dentist would drill the guy's teeth with no pain killer, right down into the nerve, one after the other, until he signed a confession. The dentist would then fill the teeth and nobody could prove anything. He said they always got confessions. The exposé program we were planning fell apart when my friend suddenly disappeared. He's never been heard of again.

I also remember my first court case in New York. I had a simple open and shut case, but my lawyer said I would have to give the judge \$5,000 if I wanted to win. I didn't see how there was any way to lose so I didn't pay. I lost.

Then there was the time I was a witness in a murder case where I had critically important testimony to give and was not allowed to give it. The murderer got off with a slap on the wrist. So much for swearing to tell the truth, the whole truth, and nothing but the truth. Not in our courts.

There sure are a lot of things we need to fix to make this the country it could and should be.

Though I've had millions stolen from me, with no punishment for the thieves, I'm still optimistic. Heck, I can always make more.

Have you had any interesting experiences with our "justice" system?

AIDS, HIV, and Other Baloney

Yes, I've been reading again, and it wasn't the new *ARRL Handbook* either. Unless you know someone with HIV or AIDS (or both), or are curious about all the fuss, you may not be interested enough to go out and buy the new Peter Duesberg book, *Inventing the AIDS Virus*. It's a \$30 722-pager and it nails the medical establishment to the wall for the mess it's made of this whole business.

Since I've read in several places that there are thousands of AIDS patients who are HIV negative, and millions of HIV positive people with no sign of AIDS, Duesberg's claim that AIDS is a lifestyle disease, particularly involving the use of recreational drugs, makes sense. He further provides exhaustive proof that AZT, which is a chemotherapy used to treat AIDS, actually is responsible for causing AIDS. He also provides proof that AIDS is not in the slightest infectious.

AIDS is actually the result of a toxic buildup from drug use. Remember the drug culture of the '60s? Well, is it really all that surprising that people's bodies eventually reacted a few years later? And since drug use is particularly rampant in the homosexual culture, this explains why the syndrome hit this group so strongly. It's similar to cigarettes, where it takes a few years of poisoning one's body with nicotine and tars before emphysema, heart trouble, lung cancer, and other illnesses caused by defeating the body's immune system inevitably appear. These drugs lower the effectiveness of the immune system, allowing any opportunistic disease to win out.

Our bodies harbor billions of microbes. Indeed there are more microbes than cells in our bodies, so our immune system is in a constant war with invaders. Anything that tends to lower the immune system can allow the bad guys to win. Our immune system suffers when we are stressed, when our bodies don't get the required nutrients, if we shortchange it on water or oxygen, or load in toxins.

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Over the past few months I've been playing around on 10 meters. Ten meters *does* open up even in these days of low sunspot activity, and due to the large number of Novice and Tech-Plus hams, there is enough activity on 10 meters that it's pretty easy to know when band openings do occur. Also, there are some tremendous bargains available in 10 meter rigs. The Uniden, Ranger, Lincoln, Emperor, and Radio Shack 10 meter rigs are showing up at very good prices (I guess the folks who bought them during the sunspot maximum are dumping them because they think 10 meters is dead most of the time).

I currently own both a Uniden HR-2600 and a Radio Shack HTX-100. (I know, I know—why do I need both a Uniden 2600 and a Radio Shack HTX-100? Well, we have two *cars!* See how easy it is to justify multiple rigs?) Anyway, when running some tests on these radios, I saw a very distinct average output power variation between these rigs. On my analog power meter (Diamond SX-1000), average talking power is around 5-6 watts on the Radio Shack HTX-100 and only about 1-2 watts on the Uniden HR-2600. Looking at the S-meter on my test receiver (my Icom IC-706), I saw a 2(!) S-unit peak difference in favor of the

Radio Shack radio. With both the Radio Shack and Uniden radios, I could whistle-up the power to the advertised 25 watts output; however, the Radio Shack rig did a much better job of keeping the "talking power" up. Hmm. So what could I do to my Uniden to make it better?

"Up" your talk power

After examining the Uniden 2600 schematic (with a magnifying glass—it is small!), I determined that there is no obvious microphone gain adjustment in the radio, so I decided to build in a microphone preamp that would give me equivalent "talk power" to the Radio Shack rig. My final circuit is shown in **Fig. 1**.

I selected the RC values to give around a 300 Hz high pass, and a 3,000 Hz low-pass cutoff. I traced the Uniden microphone connections to the main board (red and black wires), cut the red (hot) wire and inserted the circuit shown. For powering, I probed around on the PC board until I found a source of 8 VDC (regulated) and ground and tapped into these points.

Then, while talking into the microphone, I adjusted the potentiometer for the same 5-6 watts average power as seen on the Radio Shack rig. I also listened to my voice on my IC-706 and verified that there was no distortion. My final tests occurred on the air. Comments from stations I worked included "excellent audio" and "good crisp modulation." I highly recommend the addition of this preamplifier circuit to your Uniden radio.

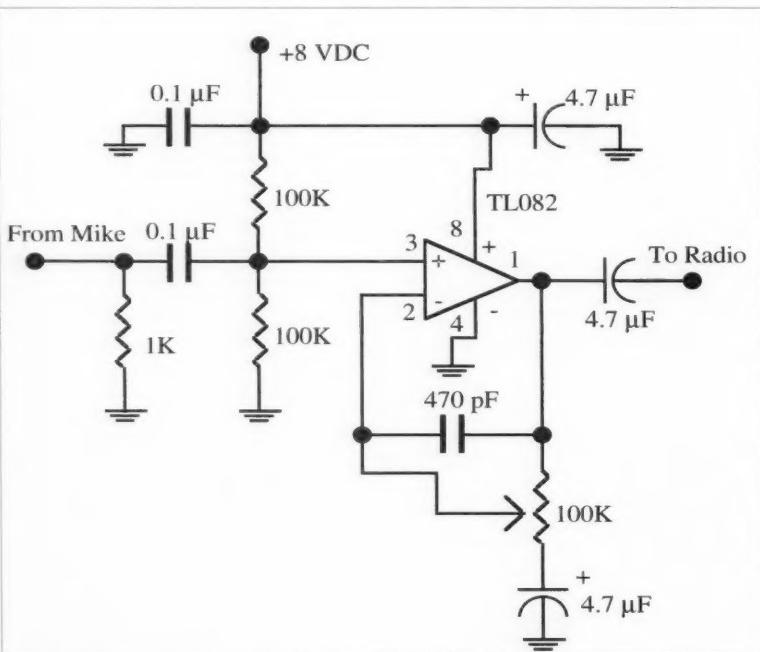


Fig. 1. Dynamic microphone preamp.

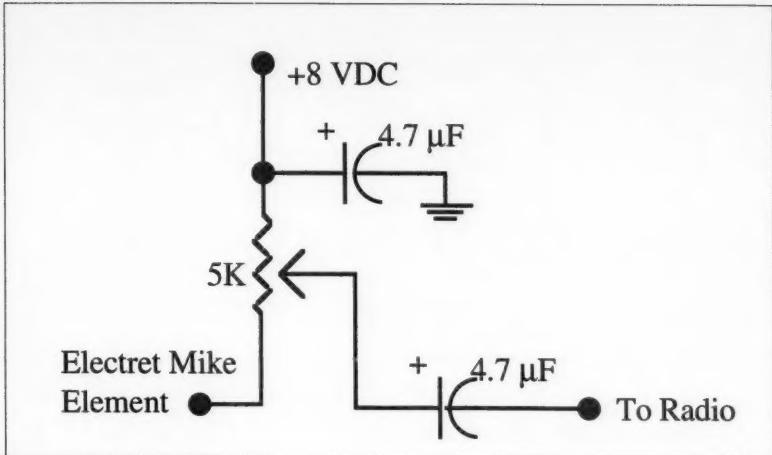


Fig. 2. Electret mike element powering.

Change the mike element

A friend of mine, Bob N5UPP, owns a Uniden 2510. This radio had a dead microphone. Since the Uniden 2510 and 2600 share the same microphone, I borrowed Bob's radio to check the "average" power and found it to be similar to that of my unmodified HR-2600. I also verified that Bob's microphone element was dead. Finding a replacement dynamic microphone element for this microphone is difficult, and dynamic elements are relatively expensive. Since Bob's 2510 could benefit from increased microphone gain, I decided to substitute a Radio Shack electret microphone element for the dynamic element. These electret elements are very small, inexpensive, easily obtainable, and they have gain.

Unfortunately, these mike elements also require powering—but this turned out to be a pretty easy fix. First, I stuffed the new tiny electret element into Bob's microphone case, added a drop of epoxy to hold it in place, and then packed a piece of foam rubber behind it to fill the large cavity left by the dynamic element. Next, I traced the microphone wires into the radio. The hot wire turned out to be a yellow wire in a large, connectorized bundle of wires. I cut this yellow wire and inserted the circuit shown in Fig. 2. Again, I probed around on the PC board to find a source of regulated 8

VDC and ground. Anyway, when everything was finished, I ran my "average" power tests while adjusting the potentiometer so that Bob's 2510 put out the 5-6 watts of the HTX-100 and my preamplified HR-2600.

Since I completed the above projects, my HTX-100 microphone failed. What is it about these dynamic elements? Anyway, I built the same electret element and powering circuit as shown in Fig. 2 into my HTX-100. In the HTX-100, the front panel circuit board uses solder bridges to attach to the main circuit board. I probed around on the solder bridges until I identified the microphone "hot" wire, removed the solder bridge, and substituted the Fig. 2 circuit across the gap. An adjacent solder trace had the 8 VDC I needed for powering the mike element. Again, I adjusted the potentiometer for the 5-6 watts average power output on my analog power meter.

Some radios can probably benefit from increased mike gain—I know the Uniden radios do. It is pretty easy to build a microphone preamp or replace a dynamic mike element with an electret mike element. Since the Uniden radios use ALC to limit the maximum transmit power, we are effectively getting some audio speech processing due to the combination of additional microphone gain and ALC limiting. Finally, both of these circuits are physically small and easily fit inside most any radio. Now if 10 meters would just open up a little more often!

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The Hamtronics model RWX is a highly sensitive and selective, professional quality seven-channel crystal-controlled double-conversion FM superhet receiver for the 24-hour NWR broadcasts from the National Weather Service (NWS). You can listen to the current weather report and forecast at any time; or, when set to "Storm Watch," the receiver will remain silent until it receives an alert tone from the transmitting station, opening the squelch so the user can hear the emergency information that follows. Crystals for all seven NWR channels are supplied.

The receiver provides room-filling volume at less than a quarter turn of the front-panel control, so there's plenty of reserve for noisy locations, mobile use, or to hear alarm-activated announcements in another room. Circuit board terminals are provided for an external

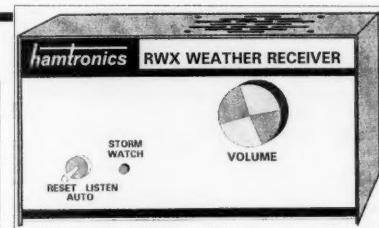
speaker. Sensitivity and selectivity are excellent. For all the audio volume and features, the assembled unit is a convenient size. The alarm output can be used, through a relay, to drive secondary alarms for those with special needs: a loud bell, flashing light, bed-shaker, etc. In its full kit or assembled form, the receiver comes with a high quality plug-in-the-wall power supply. For temporary portable use it can be powered by any source from a car cigarette lighter to 12 volts worth of AA cells, or a 9 volt battery. Watch battery polarity carefully.

"The Hamtronics model RWX is a 'must have' for hams or for anyone else involved in or affected by emergency operations due to weather."

The RWX is available in kit form, with or without the cabinet/speaker/AC power supply, or fully assembled, tested, and installed in the enclosure. Appropriate assembly and/or operations manuals are supplied with the radio in either case.

Circuit description and assembly

RF input at 162 MHz is amplified by a low-noise dual-gate FET. Double-tuned circuits provide rejection of images and out-of-band signals. The first mixer converts the 162 MHz input to the first IF frequency, 10.7 MHz, which goes through a ceramic filter on its way to an integrated circuit IF amplifier. The injection signal for the first mixer comes from a 16 MHz oscillator controlled by



the seven switched frequency systems. The signal is tripled twice, with double-tuned circuits in each tripler.

The IF amplifier chip contains a crystal-controlled 10.245 MHz oscillator, the second mixer with an output at the second IF frequency (455 kHz), a narrowband ceramic filter, and a quadrature detector. The IC audio output is applied through the volume control to an IC audio amplifier chip, which supplies both the internal and external speaker terminals on the circuit board.

The IF amplifier chip also provides the tone alert squelch function, responding to the 1050 Hz NWS-transmitted alerting tone.

Like their RWWV receiver (see review in 73, December 1995), the circuit board is FR-4, double-sided, with a continuous ground plane on the top surface; all holes are drilled and plated-through.

Follow the detailed assembly instructions carefully; the suggestions and clues are invaluable for getting good results. As in any VHF circuit, short leads are important. This is a quality circuit board; the parts all fit well, holes are properly positioned, and components solder in easily.

Following the assembly, an RF signal generator and a sensitive DC voltmeter are needed for alignment; full step-by-step instructions are included. Tables of test voltages are provided; if you can build and align the receiver, you can troubleshoot it if necessary. In case you

move or take the receiver to other locations, make a copy of the "Switch Position vs. Channel Frequency" list from the instruction manual and tape it inside the receiver.

Performance

A seven-position DIP (dual inline package) switch, or rather, set of switches, selects the crystal-controlled frequency. The switches are mounted on the circuit board, and are easy to operate with a small straight-blade screwdriver. With the frequency selected and the receiver closed up, only the necessary controls are available on the front and rear panels: volume control, Reset/Auto/Listen switch, a Storm Watch LED, and the BNC antenna connector.

Operation is straightforward. To listen to the current broadcast, set the front panel switch to "Listen." Pushing the switch all the way to the left and releasing it puts the receiver in "Auto" mode and turns on the Storm Watch LED. The radio will remain silent until it receives an NWS-broadcast alert tone. The tone opens the squelch and activates the audio at your pre-set volume.

The quality 12 VDC plug-in power "brick" supplied with the receiver provides hum-free reception.

The BNC antenna fitting is mounted on the rear panel; get a right-angle adapter for mounting an antenna right on the radio. From my location northwest of Chicago, a quarter-wave whip on the back of the receiver provides loud/clear reception of the NWR signal off the Sears Tower, 28 miles away (but then, so does a 3-inch length of wire!). The whole idea, of course, is reliable reception of your local NWR station, but I couldn't resist trying a little DXing. On a warm afternoon, with tropospheric propagation helping out, the following came in clear and strong with a 2 meter AEA "Hot Rod" antenna (telescoping end-fed half-wave), indoors: Rockford, IL (54 mi.); Milwaukee, WI (65 mi.); Grand Rapids, Michigan (140 mi.); Adams, Wisconsin (160 mi.). (Consider the additional value of the NWR stations as 2 meter propagation beacons!)

If you're located anywhere near an NWR transmitter, you should have no problem with a small indoor antenna. In more rural areas, try an outdoor ground plane, or even a vertical yagi. RadioShack™ carries a line of "scanner" antennas that should work well; amateur 2 meter antennas should work just fine.

I've owned weather receivers before. Some have been good for little more than modification to monitor local 2 meter repeaters, some have had serious intermod problems, and most have lacked sensitivity. This is my first that could be called a serious, professional-grade receiver, including the tone alert function; it provides a real measure of confidence that important emergency information will not be missed.

Call your local office of the National Weather Service for the local frequency (or just switch through the seven frequencies until you find it), and the day and time of their tone-alert test. Most seem to be on Wednesdays at noon (ours happens to be Tuesdays at 11:00 a.m.). While you're at it, ask for the current location/frequency list bulletin and other information on NOAA Weather Radio they have available. It's a good idea to monitor the tone alert test occasionally, to ensure proper activation of the Storm Watch function.

Conclusion

The Hamtronics model RWX is a "must have" for hams, CAP, Coast Guard Auxiliary, Police and Fire Departments, schools, hospitals, truck and taxi dispatchers, Scouts, outdoors enthusiasts, or anyone else involved in or affected by emergency operations due to weather. It's easy to use, well-built, sensitive, and dependable.

The RWX is available as a board-level kit for \$79; board, cabinet, speaker, and power supply in kit form for \$99; or fully assembled and tested with the cabinet, speaker, and power supply for \$139.

For further information, a catalog, or to order the RWX, write to Hamtronics, Inc., 65 Moul Road, Hilton NY 14468-9535, or call them at 716/392-9430; FAX 716/392-9420.

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The Morse code

Di-di-dah-dah-di-dit—dots and dashes. When you hear the sound, you most likely think of Morse code—right? But did you know that Samuel Finley Breese Morse's original telegraph system was not based on sound at all?

Dating back to the mid 1830s, Morse's original "receiver" was a lot like a chart recorder. It marked patterns of the making and breaking of an electrical circuit at the sending station onto paper tape. The sending station "keyed" the circuit according to an early code devised by Morse, a forerunner of the familiar dot-and-dash code still in use today—and the traditional telegraph key (**Photo A**) hadn't been "invented" yet either.

Only much later, using a modified receiver, clever "operators" learned to recognize rhythm patterns in the receiver's

"click-click" sound, and found that they could translate directly from sound to text. This receiver was subsequently refined into the familiar "sounder" similar to that shown in **Photo B**.

Morse is perhaps best known for the code that bears his name, but his approach to developing an electric telegraph, pioneering the simplex circuit (one wire pair) and using a quasi-digital signaling code, was unique. It made building a telegraph system possible and led to the communications systems we use today.

Following early trials, Morse's telegraph rapidly spread throughout America in the 1850s. Morse code, as it evolved, went on to become a world standard that has lasted over 175 years. As wireless and radio came of age, the merchant marine also adopted the code as its international standard, pretty much assuring the US a position of technological leadership in the field of telecommunication.

*"Now closing down continuous watch.
Fair winds and following seas with 73s
from all of us."* With this transmission at 8 PM (0000 Hours GMT), July 31, 1993, the U. S. Coast Guard ended nearly 50 years of continuous watch on 500 kHz, the international maritime distress frequency. On March 31, 1995, the Coast Guard discontinued all other regularly scheduled use of Morse code. Today, there is virtually no formal use of the Morse code by the US Coast Guard or military. Newer technology—satellite communication, ship-to-shore teleprinters,

and the like—is said to have made Morse code obsolete.

Technology changes but the need to communicate continues. Today, there are many technological choices, and high speed data systems have great impact on almost everyone's life. Computers, linked by digital data systems, virtually run the world.

Information is readily available. The data highway, Internet, packet webs, cellular phones, and cable are examples. Getting the message is not the problem it was in the '40s (1840s, or for that matter, 1940s). Perhaps knowing what to do with all the available information, differentiating quality from junk, is today's problem.

Standing on giants' shoulders

As with virtually all inventors, Morse didn't start in a vacuum! In the 1830s, many dreamed of building a telegraph, and some already had telegraph schemes on paper. By the time Morse started developing his ideas, a few others were well underway in perfecting theirs. Chief among these were Charles Wheatstone and Edward Davy, both from England, and both received British "telegraph" patents by 1837.

Wheatstone, now known largely for the Wheatstone Bridge, was an electrical experimenter in the 1830s. He gained early notoriety designing a method which rather accurately measured electrical propagation speed through wire in 1834. The system used a rotating mirror scheme similar to the classic Michelson velocity-of-light experiment.

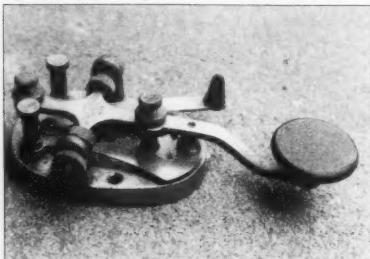


Photo A. The telegraph key.

Wheatstone went on to develop his telegraph over the following years. It initially used five circuits, each terminated with a galvanometer-like device (**Photo C**). Each such device had a pointer that could assume any of six positions according to the current level in its circuit, and with five circuits, Wheatstone could communicate 30 characters—albeit very slowly. Because of the five-line requirement and message coding/decoding difficulty, it was doomed to failure as a practical telegraph system. However, Wheatstone's galvanometer detector would later be modified to use a mirror as the indicator and find application in the first Atlantic telegraph, but that's another story.

Later, working together with William F. Cooke, another telegraph inventor of the time, Wheatstone refined the design to require only three circuits and indicators. This basic system would find early use in England and parts of Europe.

Edward Davy also received a British telegraph system patent in 1837 because of a couple unique features his system had. It was a multi-wire device like Wheatstone's and Cooke's, but Davy designed a repeater circuit which in itself would find later use by others in relaying signals over long distances.

In Germany, experimenters made an early discovery that would also be of use to later telegraph builders. They discovered that a single wire could be used in a (telegraph) circuit if the earth were used to complete the circuit pair (one leg grounded at each end of the link). This discovery was not generally known until after 1837, so Morse did not make use of it initially. Also, Morse's first major test link was begun using an underground line which would have been difficult to insulate, given the state of wire insulation quality at the time.

There was another development, in electrical technology which would prove beneficial to telegraph builders—the battery. Until its emergence, most electrical experimenters were limited to using a galvanic cell which produced about 1 volt. John William Daniell, an Englishman, discovered that cells could be connected in series to form a battery. The increased voltage available from such a battery would solve many problems caused by wire resistance and other circuit losses in telegraph lines. Keep in mind that while Georg Ohm had already

formulated his "Ohm's Law," these principles were still a mystery to most electrical experimenters of the time.

America's Joseph Henry was another contributor to the telegraph's development by providing advice and theory on electromagnetics. Since most of the contending electric telegraph systems employed some sort of electromagnetic receiving device, the emergence of sensitive and efficient electromagnets solved a major problem impeding the development of long lines.

There were many more contributors whose ideas were "borrowed" and used in the development of the electrical telegraph.

Putting all the pieces together

Exactly how Morse acquired the various pieces of technology needed to produce a functional cross-country electric

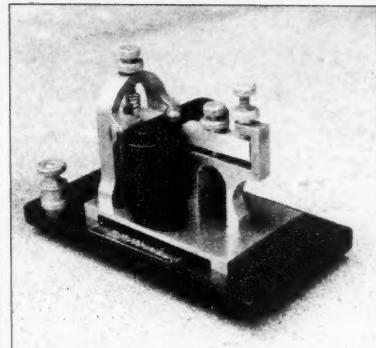


Photo B. The sounder as shown was used in telegraph offices beginning in the second half of the nineteenth century, and many were still in use through the 1930s.

telegraph has long been debated. His early notes, for example, indicate he had a basic knowledge of electromagnetic devices. How he acquired this knowledge was the basis of a lawsuit brought

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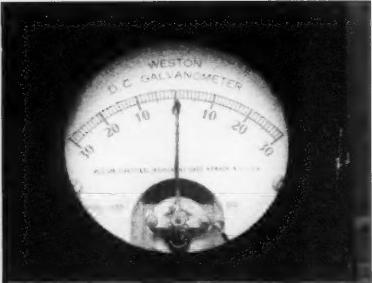


Photo C. A modern version of the galvanometer. Used today as a laboratory instrument, its development was one of the earliest examples of converting an electrical current into mechanical motion.

by one Dr. Jackson, a fellow passenger on a ship carrying Morse across the Atlantic in 1832. Morse had been traveling in Europe, purportedly trying to further his career as an artist. It is generally thought that until his trip back to the United States, Morse didn't know what a telegraph was—but by the time the ship docked, Morse had compiled fairly complete design notes which he subsequently used in building his first telegraph. Jackson, a chemistry professor and amateur electrical experimenter, would later claim the telegraph idea was his. One of the many mysteries of technology. I suppose there are other examples, but in researching the history of electrical communications, I was surprised by the number and the ferocity of the legal battles associated with it!

Morse, though well educated, always had a tough time earning a living, compounded by the burden of raising his children alone, his wife having died quite young. This, coupled with living an artist's life, made him quite familiar with tough times. Had he not known trouble, though, he might not have had the personal fortitude necessary to get through the many ordeals he would face during his telegraph system's initial development.

Things weren't going too well...

In 1835, Morse got a teaching post at the newly organized New York City University as a literature professor. This was fortunate because it allowed him access to some of the university's facilities, and he needed lots of space to set up his equipment and carry on experiments

between classes. He also found access to resources and other help unique to a university's environment.

One such resource turned out to be Dr. Leonard Gale, a chemistry professor also at the university, and knowledgeable in electricity. Gale was familiar with the Daniell battery and convinced Morse to try using it. They were to form a lifelong friendship.

Gale also spotted deficiencies in Morse's electromagnet designs and provided him with information about Joseph Henry's earlier work. This lead to Morse's producing electromagnets with many more turns of wire than he had ever before used, resulting in much superior performance.

By 1837, Morse had several hundred feet of wire strung around the university halls enabling him to stage demonstrations and test various improvements. Also in 1837, news of Wheatstone's British telegraph patent was getting around, which prompted Morse to register his work with the US Patent Office.

Actually Morse had received a copy of a letter circulated a year or so earlier by the US Treasury seeking ideas for establishing a government telegraph system, and he replied with a description of his system, as it stood, in 1836. Responding as he did, at the time he did, was fortunate for Morse, as this letter would later be his strongest claim to patent rights for his system.

During Morse's tenure at the university, he staged several demonstrations of his system as new developments were added. During one such showing in 1837, a young man named Alfred Vail turned up. He was so impressed by the telegraph that he recruited the interest of his father, George Vail, owner of the Speedwell Iron Works in Morristown, New Jersey, a successful manufacturing business of the time.

Morse's partners

As a single parent on a meager university salary, Morse hadn't been able to invest much money or time in his telegraph. The Vails, on the other hand, had money—at least Alfred's father did, and they were willing to invest some in Morse's telegraph. Alfred also wasn't terribly busy at the time and had time to spend on it.

Besides money, Alfred Vail brought a good mechanical aptitude to the telegraph project, having acquired it hanging around his father's iron works. Morse's strengths lay more in the abstract: ideas, research, etc., and thus his equipment lacked both electrical and mechanical sophistication prior to Alfred's showing up.

With Alfred on the job, things began taking on a new look. By early 1838, the two men had perfected the system to the point where it was ready to come out of the laboratory.

They made good partners. One of the first innovations to come out of the Morse-Vail partnership was redesign of the receiver. They changed it such that the paper tape marker now moved vertically, up and down, thereby marking the paper with dots and dashes instead of the previous zigzag pattern. At this point, copying was still done by translating the marks from the tape after the entire message was received. This new receiver did make a click-click sound as it marked the paper tape, though.

Another significant improvement made during this time was replacement of Morse's old cam strip sending system with a "key." Morse's cam strip was akin to a teletype machine's punched paper tape and required that the message be composed prior to sending. The addition of a key allowed direct sending in real time.

From 1838 on, the Morse and Vail Partnership would endure. During this time, Morse also acknowledged his old university colleague, Dr. Leonard Gale, as partner because of Gale's earlier electrical contributions to the system. Morse also recognized Vail's father, George, as a partner, largely because of the money George spent on the project. Later, Morse would find other "partners" he didn't know he had!

A government partnership

While the Vails had deep pockets, estimated costs for building a test line, even over the relatively short distance of 50 to 100 miles, was more than they were willing to spend at the time.

Morse himself didn't have the money, and other investors were reluctant to invest because as yet, no one could see the telegraph as being economically viable. A telegraph, though now possible, was

largely regarded as somewhat of a novelty. Faced with this, Morse decided to turn to the government, and began trying to sell the Congress on funding the first line.

In February, 1838, having seen an impressive laboratory demonstration, a Congressional Committee recommended an appropriation bill to build an experimental line, but the bill failed to pass. For the next two years, the Morse system sat idle while Morse tried to raise money for the project.

During these two years, Morse traveled to Europe seeking foreign support. While there, he approached the English, French, Germans, and Russians in a futile attempt to obtain backing. As one account goes, he was rather badly received in England where Wheatstone was busy promoting his system, and as another story goes, he managed to alienate the Czar of Russia so completely that any mention of the Morse telegraph was banned in Russia. Morse fared no better anywhere else either—foreign diplomacy was not his calling. He didn't raise a dime!

Tail dragging, Morse returned to a rather interesting homecoming. Upon arrival in New York, he found he'd been sacked by the university, which was beset with hard times of its own. Professor Gale, his old friend and partner, was also affected and forced to find a new job out of town. Morse then learned he was being sued by good old Dr. Jackson over whose idea the telegraph really was. Finally, to completely round things out, Morse learned the Patent Office had issued Wheatstone the first US telegraph patent ahead of his own pending application.

Although things looked grim, Morse continued to lobby Congress to fund the project over the following three years. During this time, he was reduced to abject poverty, relying on tutoring art students to make ends meet. Finally, by March 3, 1843, the appropriation bill passed the legislature and was signed by President Tyler. Persistence had paid off at last!

"What hath God wrought?"

Morse had already given up hope for 1843, believing this legislative year had come and gone like those previous. Ann Ellsworth, young daughter of

a Washington official, delivered the news of the appropriation bill's passage to Morse a day later. In gratitude, Morse promised her she could name the first message to be sent over the completed line.

The experimental line was to link Washington with Baltimore. Originally, Morse and company planned to bury the line underground due to fears over possible damage by the elements. Unfortunately, that failed after almost nine months of construction, when it was discovered the wire insulation used was inadequate. Switching gears, they started stringing wire on poles overland. On May 24, 1844, with Alfred Vail in Baltimore monitoring, Ann Ellsworth handed Morse her message. It was from the *Book of Numbers*, "What hath God wrought?" Morse personally tapped it out from Washington. Within minutes, Vail signaled back that he had the message and repeated it back over the line as proof the system worked.

The inauguration of the first operational link initially received a lot of attention in 1844, but there wasn't exactly a stampede of people wishing to send telegrams from Washington to Baltimore. It even took some time for the news media to recognize its value. With no immediate financial incentives for

building additional telegraph circuits, Morse's system sat relatively unused for some time.

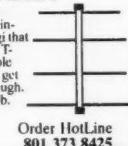
One of the early events to awaken public awareness of the telegraph's value occurred somewhat by chance. The Democratic National Convention happened to be held in Baltimore the summer of 1844, soon after startup of the new line. As one might expect, there was a lot of interest in Washington over what was going on in Baltimore. This interest heightened after James K. Polk received the Presidential nomination, a surprise—followed by a bigger one. Silas Wright was named the Vice-Presidential nominee, and he, upon hearing the news in Washington, announced he would refuse the nomination.

Morse sent a telegram to the convention in Baltimore with this news, but the conventioners initially refused to accept the telegram's authenticity. After the message was in fact verified (by railroad dispatch), negotiations began, by telegraph, to resolve this nomination dilemma. It ended with the nomination of, and acceptance by, George M. Dallas to replace Wright. While this incident may seem a minor piece of historical trivia, it served to trigger a few key people to recognize the telegraph's potential.

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AN758	(300W)	
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Morse viewed the telegraph as a public utility and continued to operate the Washington-Baltimore line as a free service for a time, but Congress remained uninterested, and the system remained primarily a curiosity. At this point, the Post Office decided to fund the line as part of its operations, but after sustaining two years of losses (they charged 1/4 cent per word), the government got out of the telegraph business.

Earlier in Morse's Congressional lobbying days he'd met Francis O. J. Smith, then the Congressional Chairman of the Commerce Committee. Smith had, at that time, convinced Morse to give him a share of the telegraph system in exchange for Smith's peddling his influence to help raise money. Smith apparently didn't have the influence he thought he had because he was able to raise only dust, not money, during this time.

Smith had since left public life to become a promoter of sorts, probably a better career choice for him. Still claiming his part ownership in Morse's telegraph, however, Smith attempted to form a private company to build a line between New York and Boston. Unable to sell this idea initially, Smith turned to building a line from New York to Philadelphia, and by late 1845 had raised enough money to begin construction.

By early 1846, the line had reached the Hudson River at Newark. While the British had perfected submarine cable technology, Smith and company's cable was not capable and failed under water. This forced temporary use of a river-ferry relay in order to get the line operational by summer.

Near the end of July, 1846, the company began reporting "profits," thus touching off a wave of expansion. It should be noted that the actual profitability was dubious at best, but reporting profits sure made stock sales easy! By 1849, many lines were in and actually *were* making money, partially due to news service and railroad business. In time, Morse gained a fortune through expansions by Western Union and the American Telegraph Company, as did virtually everyone else associated with the telegraph.

By 1860 most of the Eastern US was linked by telegraph lines, and by 1865, the US was linked to Ireland and Europe by the Trans-Atlantic Cable.

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NEVER SAY DIE

Continued from page 31

But what about all those hemophiliacs who've been dying of AIDS as a result of blood transfusions? It turns out that's tied in with a new drug for hemophilia called Factor VIII. This is an immuno-suppressive drug, so if the patient also is also HIV positive, the chances are that a doctor will prescribe FDA-approved AZT, and that's the end.

Maybe you've noticed that none of the AIDS establishment's frightening predictions have materialized. Our hospitals are not packed solid with people dying of AIDS. The big winners have been the condom manufacturers, Burroughs Wellcome Labs and their AZT sales, the AIDS support groups, and those benefiting from the billions of government money that Congress has thrown into fruitless research (welfare for scientists).

The Duesberg book is a fascinating (if long) detective story, and there is no shortage of bad guys put into the spotlight.

So then how are the Bioelectrifier and the Beck Blood Purifiers pulling so many people back from death? I suspect that by passing a tiny electrical current through the blood it prevents various viruses, microbes, fungi, yeasts and parasites from replicating, thus allowing the immune system to regain enough strength to fight off any number of illnesses which had gotten the upper hand. Like cancers.

And combined with the damage done to people's bodies and immune systems from long-term drug use (including nicotine and alcohol), there is the mutation of microbes which had previously been beaten back with antibiotics. In case you haven't read, most of our more serious invaders are now antibiotic resistant, and the rest are well on their way.

This onslaught of infectious diseases also helps defeat the immune system. If you haven't read about it, the current estimates are that over 80,000 people died in 1996 in hospitals just from diseases contracted in those hospitals. That's right, not from the illnesses which brought them there, but from those contracted while there. A hospital is a very dangerous place to be.

I'm not sure whether that 80,000 is in addition to, or part of, the 300,000 deaths the Ralph Nader researchers attributed yearly to hospital errors—mostly errors in medication. I suspect it's in addition.

Dr. Fisher Disagrees

But not a whole lot. In *The Plague Makers*, Dr. Fisher presents a well-researched case targeting not only recreational drug use as knocking the immune system down, thus allowing the AIDS syndrome to happen, but he presents a solid case that the over-use of antibiotics by two specific groups, gay men and drug users, has significantly contributed to the destruction of their immune systems. Both gays and intravenous drug users are constantly having to fight off infections, hence their high use of antibiotics.

If I had any sort of immune systems related illness my first move would be to do everything known to get my immune system perking at peak efficiency. I'd follow the Comby book's raw food diet and change my eating habits immediately. I'd get those UVs into my eyeballs every day, per Dr. Douglass. I'd be out there briskly walking for several miles a day, rain or shine. I'd hyperventilate every hour or so to get more oxygen into my system. I'd make sure I was drinking at least eight glasses of distilled water a day. And I'd use the Bioelectrifier at least an hour or two a day. I would not take any prescription drugs (or other drugs, for that matter). I would make sure I was getting vitamins A, C, and E.

Scientists

A letter from Albert KE4HUD included a newspaper clipping to the effect that the job market is tight for scientists. Now, I'm a real big fan of science and believe that we have a serious need to get our kids interested in high-tech careers. But I don't think I've ever promoted the idea of anyone going on to become a scientist. In general, scientists tend to be a mile deep and an inch wide in their fields, wear lab coats and be super-nerds.

Looking at it from the career point of view, with very few exceptions scientists are never going to make much money. Job-wise they're heading toward one of two possible employment opportunities: working for a large corporation, or a university. Neither of these is ever likely to pay much except in prestige (oh, vanity).

The odds for making money these days lie in being an entrepreneur, and here a high-tech background can be worth zillions. Ask college dropouts Bill Gates or Steve Jobs.

Continued on page 43

The Gel Cell Storage Battery

A great little power supply.

Frank Brumbaugh KB4ZGC
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The gel cell storage battery is the king of batteries both for portable operation and for emergency backup power in the ham shack. This type of battery has a great many advantages over other kinds.

Gel cell batteries are tightly sealed, so they can be stored, charged or discharged in any position with no danger of electrolyte leakage or outgassing. No maintenance is ever required.

These batteries are cost-effective, providing a high watt-hour per dollar value. They are widely available from a number of manufacturers and are low in cost, considering their power capability and usual life spans.

In normal use, the dependable service life of gel cell batteries is four to five years when used for standby use, and between 200 and more than 1,000 discharge/recharge cycles as a function of the amount of power delivered before recharging. Gel cell batteries do not have "memories" such as haunt NiCd batteries.

Gel cells possess a very high energy density, resulting in smaller physical size for the amount of power they offer. They are available in many sizes (from vest-pocket to hernia-inducing), and in voltages of 2, 4, 6, 12, and in some cases 24 and 28 volts. They can be connected in series for higher voltages, and/or in parallel for higher load current capacity.

Gel cell batteries can be charged over a temperature range of -20°C to +50°C (4°F to

+122°F), and can be used to produce power from -40°C to 60°C (-40°F to +140°F).

Although it's not recommended, gel cell batteries can be discharged much below the normal level (in an emergency), yet retain the capability of fully recovering when recharged. These batteries can also, in pulse type service, supply up to 10 times the ampere-hour capacity of the battery for these very brief pulse periods. Thus, smaller batteries can be used when very high peak current is required for very short time periods without damage.

Gel cell batteries are ideal for portable operation, especially for low power stations, and most QRP operators in this rapidly growing segment of ham radio use these efficient batteries to power their rigs when hiking, backpacking or camping. These batteries are an obvious choice for Field Day, and there are quite a few bicycle mobile stations using gel cell batteries for power.

The larger capacity batteries are most desirable for backup power in the home station, and are usually continually floated across the +13.8 VDC output of the station power supply. This keeps the battery fully charged and ready to supply power to the ham station should commercial power be lost.

Inside that neat plastic box

Fig. 1 illustrates the internal construction of a typical gel cell storage battery. Lead-calcium plates containing a small amount of tin are very strong, durable, and highly resistant to warping or damage due to excessively deep discharging. The electrolyte, a dilute sulfuric acid similar to that used in automobile and marine batteries, is locked into a gel almost like candle wax, keeping it constantly in contact with the plates.

Separators between positive and negative plates are usually made of porous Fiberglas™ cloth which is highly resistant to heat and

oxidation. This cloth easily absorbs electrolyte, further stabilizing the battery.

Many gel cell batteries contain a pressure relief valve, as shown in **Fig. 1**. This comes into play *only* with excessive gas pressure caused by overcharging. It is a one-way valve and does not allow ambient air to enter the battery. With normal charging there will never be an occasion for this valve to operate. It is strictly a safety device for a worst-case situation.

The gases produced during charging—oxygen from positive plates and hydrogen from negative plates—combine to form water, which maintains the water content of the electrolyte at the proper level, making a truly "maintenance-free" battery.

The battery case is sealed both mechanically and with epoxy, plastic or hot seal to produce a liquid- and gas-tight container.

Battery capacity-discharging

Gel cell batteries are available with ampere-hour (Ah) capacities of 0.05 to 100 Ah, rated for a 20-hour discharge rate. Capacity in Ah, always expressed by the capital letter "C," is used when calculating or expressing the *rate* of charge or discharge. The Ah capacity of any battery is equivalent to C in all cases. This means that the number of Ah (C) discharged at a rate of 0.05 C, will discharge the battery fully in 20 hours. If the discharge rate is higher, for instance doubled to 0.1 C, the fully discharged state will be reached in just nine hours. Discharge rates are constant in this example, but would be reasonably accurate for average discharge current. These examples apply to all gel cell batteries, regardless of terminal voltage or Ah capacity.

As a concrete example, a battery of 2 Ah (C=2) will supply 130 mA for 20 hours, but if called upon to deliver 260 mA, the battery will be fully discharged in

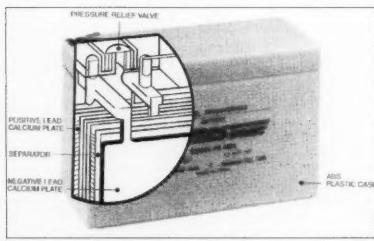


Fig. 1. Internal construction.

nine hours. At the high drain of one ampere ($C/2$), this battery would be discharged in only one hour 20 minutes.

The fully discharged gel cell battery will produce a *per-cell* voltage of 1.75 volts. For a nominal 12 volt battery such as is used by most hams, this is a terminal voltage of 10.5 volts. Conversely, a fully-charged battery will have an open circuit voltage of 2.15 volts *per cell*, or 12.9 volts for a 12 volt battery.

It is best, if at all possible, to refrain from discharging a battery below 1.94 volts per cell. This amounts to 11.64 volts for a 12 volt battery. Because most ham transceivers either quit or operate poorly as the supply voltage sinks towards 11 volts this is not a hardship, and halting discharge current while battery voltage is above the fully discharged state will contribute greatly to overall battery life.

If you're interested in the gory details of discharge curves and more technical information that you'll probably need in this incarnation, ask a manufacturer for their literature.

In choosing a gel cell battery for portable operation, calculate the current your rig draws on receive, and if using CW or SSB, one-half of the peak current drawn on transmit.

Assuming you wish to operate a maximum of 20 hours before recharging your battery, your *average* current drain must not exceed 0.05 C. Preferably it should be less.

Because most operating time is spent tuning and listening on receive and only a small amount of time is spent actually transmitting, unless you're as long-winded as I, a simple way is to calculate the current in Ah used during a one-hour period, with perhaps 50 minutes receive and 10 minutes transmit.

Calculate $5/6$ of receive current drain. Then calculate $1/6$ of *peak* transmit current drain and divide this by two because the intermittent nature of CW and SSB can be construed as a 50% duty cycle. Then add the two final calculated values together. The sum is your average current drain in amperes for one hour of operation.

A real life example: I have a 12 Ah gel cell ($C=12$) which powers a QRP-plus transceiver. Receive current is about 0.2 A, and half the 1.5 A peak transmit current is 0.75 A. Taking $5/6$ of 0.2 A, which equals 0.167 A (rounded off), and $1/6$ of 0.75 A, which equals 0.125 A, and adding these values together gives a total *average* current drain of 0.292 Ah *per hour*.

The 20-hour discharge curve shows that 0.05 C is 0.6 A for this battery. A simple ratio calculation is: $.6 : .05 = .292 : x$; $.6x = .0146$; $x = .024$.

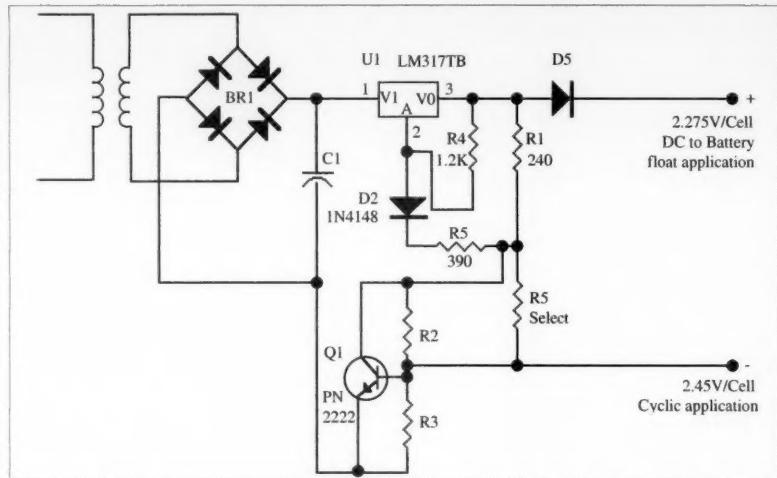


Fig. 2. Constant current/constant voltage charge circuit.

Thus, in this case, the average current drain is equal to 0.024 C, about half of 0.05 C, so the 12 Ah battery will allow about 40 hours of operation before having to be recharged.

Using a calculator, it is much simpler to calculate the ratio with the decimal fractions rather than first converting them to powers of 10 as is customary.

Charging the battery

A new gel cell battery, although fully charged by the manufacturer, needs a bit of exercise to develop its full capacity. This can be accomplished either by floating the battery across the station power supply for a couple months. This is simplest if it is a backup battery for the home station; or has been used for a while, undergoing a number of charge/discharge cycles.

A voltage somewhat higher than 2.15 volts *per cell* (12.9 volts for a 12 volt battery) must be applied across the battery terminals. After discharge, and after charging, the terminal voltage may be temporarily lower or higher, respectively, but in a short while it should stabilize at the 2.15 volt per cell level.

The best charging method recommended for gel cell batteries is the "constant voltage, constant current" arrangement. This will ensure maximum battery life and capacity while not requiring excessive charging time. However, the charging current must be so limited that it cannot exceed 0.25 C, or 1 ampere for a 4 Ah battery, for instance. *This is most important to prevent damage to the battery!*

A large capacity gel cell battery used in float service as backup power for the home station is never discharged very deeply,

and recharging requires a *lower* maximum voltage for charging.

Caution: In all cases the charge current must never be allowed to exceed 0.25 C or the battery could be damaged.

The recommended float voltage is 2.25 to 2.3 volts per cell, or 13.5 to 13.8 volts for a 12-volt gel cell battery. This allows the battery to be connected permanently across the output terminals of the standard 13.8 volt station power supply. If the home station is used at least weekly, the standby battery will never need charging unless it has been used in an emergency to power the station.

Constant voltage/constant current charger

Fig. 2 illustrates a simple charging circuit suitable for the small gel cell batteries normally used for portable operation. Because a heat-sunked 317T regulator is used, the maximum current is limited to one ampere. RS is chosen to provide the proper minimum float voltage ($0.6/R_3 = \text{max}$).

R2 and R3 are determined by the level of filtered DC voltage available and the maximum current (0.25C or lower) to be applied to the partially or fully discharged battery. They will have to be determined empirically.

The manufacturer of your gel cell battery will usually recommend a charging circuit for your application if you list your expected average and peak current drain and the acceptable discharge terminal voltage when you write. He not only wants your battery to provide efficient service but he also wants to sell you a replacement battery when the time eventually arrives.

NEVER SAY DIE

Continued from page 40

And the way the world is going, the big money is going to be in high-tech businesses for a long time to come.

It is unfortunate that around 95% (or more) of hams memorize the Q&A manuals to get their tickets and the learning process stops soon after. Here's a hobby that offers a world of learning opportunities, with it being fun every inch of the way. But yes, it does take some determination and perseverance to learn about radio, microwaves, digital communications, and so on. And yes, our blessed school system spends K-12 at a minimum doing its best to kill whatever sparks of motivation might have been inherited genetically. Grumble.

Fluorides. Again.

Are you still drinking tap water? What does it take to get you to get a small still and start distilling that sewage your city or town is providing? You don't need any of the toxic metals that come out of your spigots. Worse, you surely don't want to put chlorine into your body, and the chances are that your water system has plenty of that poison.

But the most damaging of all the water additives are fluorides. Oh, there goes Wayne, on some sort of an ecological kick. Oh yeah? If you send me an SASE I'll send you a copy of the results of 30 research lab reports of genetic damage caused by fluorides, plus a list of 35 published peer-reviewed papers attesting to the genetic damage. These research reports show clearly that as little as one part per million of fluorides in drinking water causes measurable genetic defects in sperm chromosomes, and that means some sort of genetic defect will be passed along to your children. And this is not going to be helpful. This can mean small or large birth defects, none beneficial. And these will, in turn, be passed along to your grandchildren. That what you want?

I started out buying gallon bottles of distilled water from the drug store, then Pat Flannagan mentioned an inexpensive still available from Damark. I invested in a Genesis unit, which cost under \$200. Works like a charm and has paid for itself many times.

The Dr. Yiamouyiannis book, *Fluoride, the Aging Factor*, which I've reviewed in my editorial, and is on my list of books you're crazy if you don't read, has the subtitle, "How to recognize and avoid the devastating effects of fluoride."

You've read about the decreasing sperm count in American men. Well, fluoride in the water supply has been shown to do this. It's a deadly poison, and helps knock the stuffing out of your immune system.

Do It Yourself!

Put yourself in my chair—well, walk a mile in my moccasins, is the cliché. Suppose you were writing an editorial every month,

Continued on page 55



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CIRCLE 341 ON READER SERVICE CARD

The Ten-Tec T-Kit 1208 6 Meter Transverter

Here's a fine introduction to modern kit-building.

Peter A. Bergman NØBLX
3517 Estate Dr SW
Brainerd MN 56401

A converter allows your receiver to tune a band for which it was not originally designed. A *transverter* allows your transceiver to receive *and transmit* on a band for which it was not originally designed, by subtracting or adding a local oscillator frequency—in this case, 36 megahertz—from or to the displayed frequency on your transceiver. This gives you access to the added band with all of the wonderful features already present in your expensive HF rig, without spending piles of money.

Suppose your license does not allow you to transmit on the 20 meter band? This is not a problem because you aren't transmitting on 20. Instead, you are using your 20 meter transceiver as a tunable IF stage to control the transverter on 6 meters. If your HF rig will only transceive from 14 to 14.35 megahertz that's still not a problem since a lot of the action is between 50.0 and 50.35 anyway. Receive coverage up to 18 MHz lets you monitor the rest of the 6 meter band.

If you've never built a kit...

Despite some things you may hear about the "Golden Age" of kits, modern kits are great, and when you get a kit from an outfit like Ten-Tec you can burn near write off the cost as tech-school tuition. Add in entertainment value and the satisfaction of a working unit you built yourself and you're way ahead.

Okay, you are thinking about ordering the T-Kit 1208, but what do you need up front? First, a 20 meter transceiver capable of being adjusted to 5 watts output reliably.

Second, a regulated, well-filtered 12-15 volt DC power supply capable of about 4 amps. Third, some kind of 6 meter antenna. A dipole will do for starters. And, a 52 ohm dual PL-259 jumper to connect the rig to your new transverter.

Tools? You will need a 15 to 35 watt soldering pencil and thin-diameter rosin core solder. This is a must. Thin-diameter. Rosin core. You will also need diagonal cutters—small ones—and needle-nose pliers, ditto. I like to keep a pair of locking forceps handy. They make great heat sinks while soldering and are useful in many other ways. According to the T-1208 manual, the coils can be wound on a .313" X-acto™ knife handle or a clean 3/8" bolt (that's what I used). The book also said you'll need a wire stripper. That's what I used the X-acto knife for. Alignment tool. Do not try using metal hex wrenches, screwdrivers, etc., as alignment tools. If you don't have any yet go to Radio Shack™ and get their 64-2220B set. I also like to keep a sharpened dental pick on my workbench. It is very useful for clearing holes I soldered shut accidentally, and for unbending coax. A 2- or 3-inch paintbrush is also useful for cleaning up.

Test equipment

You've got to have a volt-ohmmeter for this project, and once you get one you'll use it for years. There are some inexpensive digitals available but the better quality you start with the happier you will be with it. I know that a lot of you have tons of test gear but I'm talking to the folks who are just getting started in this great hobby. You will also have to have an accurate RF wattmeter that has a 10 watt scale or slug. If

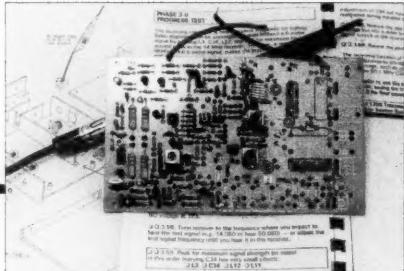


Photo A. The T-Kit 1208. (Photo by NØBLX.)

you have a cheapie from your CB days find someone with a Bird to check it for you. Then you can make a correction chart for yours.

Optional test equipment includes a frequency counter and an RF signal generator. I used my MFJ™ antenna analyzer for both jobs. For a second piece of test gear—after the VOM—I'd say that a 249 or 259 from MFJ is hard to beat.

Start your kit

The parts are packed neatly by type in separate bags but let's leave them alone for a while and take a look at the instruction manual.

Kit builders seem to fall into two categories: those who read and follow the directions and those who don't. I try to stick with the former group. More of my projects work that way.

The 1208 manual contains about 80 pages; the print is clear and the text and drawings are concise. A tip of my hat goes to Ten-Tec and Dan Onley K4ZRA who did the writing.

On Assembly page 48 is an important notice about driver transmitter power. Although there are several notices in the manual which tell you that the 1208 was designed to use a 5 watt input, it also explains that changing the value of R5 will allow inputs from .25 watts to 8 or even 10 watts.

It seems to be a fact of life that however well the manual is written there are always some addendum sheets. Go through them carefully and make any needed changes to the manual before starting construction. I

like to run copies of both sides of the addendum sheets and cut and paste them in the appropriate places in the book.

Even if you have built kabillions of devices, and especially if you have not, read the theory section. It will help you understand what you are doing and will explain why the designers made the decisions they did. After that, do the parts inventory.

Each of the seven assembly phases includes a schematic and board layout diagram of that phase, which is very helpful. Phase 1 is preceded by a "dos and don'ts" page so that is a good place to start actual assembly. Somewhere in your collection of baggies is a tiny ferrite bead—about the size of a mustard seed. Following "do 1" install that bead now. That way you won't have to worry about where the little rascal went later after you have been chasing the other parts around for a while.

The first page of construction is board preparation, installing "vias," which ensure that the upper and lower ground planes are tied together. You will also install a few test points and fabricate the test plug. A word of warning to the uninitiated: The test plug requires a 1/4 watt 150 ohm resistor, not the 3/4 watt you will be wanting later.

Another word of warning: I don't care how much money your mother makes or who your dad knows or how big your brother is, please, never, never carry molten solder to the joint on the tip of your soldering pencil. The actual amount of solder you'd have to spill on the board to create hair-pulling problems is infinitesimal. Instead, heat the joint with the tip of the soldering pencil and apply the solder to the other side of the joint. The solder will melt and flow towards the heat and if everything is nice and clean—as it probably is—you will produce a nice, shiny, conductive joint that will stay that way for years.

Yet another warning: Don't use steel wool to wipe off the tip of the soldering pencil. Sure, it does a great job but you will probably have tiny wild hairs of wire all over the place.

If you follow the manual's directions you will not get the 3.3 μ H inductor mixed up with the 3.3 ohm resistor. The resistor goes over near where you'll install Q11 later. Handle these small inductors carefully, especially when bending the leads; I managed to torque one in half. T-Kit sent me a replacement as soon as I called, but it's embarrassing and stops production.

Observe polarity—orientation—on all semiconductors and electrolytic capacitors. Every time. I go so far as to install the resistors so the color-code reads the same way. It helps keep me in the habit of paying attention to the orientation and later it might help during troubleshooting. Looks neater too. When installing disk capacitors I try to install them so that I'll be able to read the value code easily after the surrounding components have been installed.

Double-check your work.

We're having fun now

Now comes one of the really fun parts—the Phase 1 progress test. Unlike the "Good Old Days" modern kits like this one are designed to be assembled in functional stages so that each stage can be tested with power on. This way, as you progress through assembly you know you left good stuff behind you. If you skip the progress checks and run into problems later you'll have to go through the entire

"Using just an indoor dipole antenna, I could hear stations all up and down the East Coast clear into Canada from my home in Minnesota. What a gas!"

device to figure out why. Minimum test equipment is an FM broadcast receiver tuned to 108 MHz. Got one, right?

The easiest way I found to perform the Phase 2 progress test was to use a coax adapter on my 4-5 watt 2 meter rig. If you use a transmitter capable of more power make absolutely sure that the output is reduced to 5 watts.

No matter how you feel about progress tests, make sure the TR circuitry works at this point.

There are at least two reminders to make sure that J2 is securely soldered to the top ground plane. Read and heed.

Follow T-Kit's suggestion about putting a spacer between the coil and the board while soldering. You definitely do not want the coil touching the ground plane at any point.

While installing Q15 you may wonder why the designer didn't have you do that before you soldered all those other parts around its space. All the heat you were pouring into the board in that area would

not have done the transistor any good. The same is true of the rest of the semiconductors on the board.

When bending the leads on Q15 hold the lead with the tip of your needle-nose pliers next to the transistor body. Work carefully and make sure to bend the leads so they all slide easily through the mounting holes. If you just sort of line them up and pull from the other side of the board you may create enough strain to break the transistor.

As luck would have it, when I got to the Phase 3 alignment test the band was wide open and, using just an indoor dipole antenna, I could hear stations all up and down the East Coast clear into Canada from my home in Minnesota. What a gas!

During these power-on tests and adjustments you will really be glad you took your time and got everything to work as you went along instead of slapping things together and hoping for the best.

I deviated a bit from the order in which the steps are presented in the manual. At one time or another I've worked on everything from typewriters to bulldozers so I have a feel for how I want things to go together. For example, I found it easier to rearrange the steps so that I worked from the bottom to the top when wiring the switches and from left to right when wiring the SO239s.

Make absolutely sure you adjust the lengths of the coaxial cables so that they can be bundled neatly per the instructions. If they are just strung randomly across the board all sorts of unpredictable things can happen. Also, watch what you are doing when cutting the coax. Somehow I ended up with two inches in my hand that needed to be in the kit. Fortunately I had some in the junk box.

Final alignment

You had the receiver working, transmit bias adjusted and reasonable RF output before you installed the board in the case, right? If everything is working to your satisfaction, you are just about finished. You might want to find a spot inside the case to store the test plug, as I did.

The fun of building has actually just started for you because every time you sit down to work you'll know you built it yourself. Have fun on the "magic band" and 73s.

RTTY LOOP

Amateur Radio Teletype

Marc I. Leavay, M.D., WA3AJR
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Every February I get this image, somewhere, of a ham poking his head up and looking around, like the groundhog on February 2nd. But unlike the groundhog, who is looking for his shadow and in that search judging the coming weather, our amateur buddy is looking for software to enable entry into the digital universe.

The questions I receive reflect the great diversity of that quest. Bob Rushby VE3GLA sent along a note saying:

"I've been active on RTTY for some time with a MFJ-1278. Recently, I got the chance to buy an old HAL ST-6000 for a very good price. I'd heard great things about how well it works in weak signal conditions, so I bought it.

"My big problem now is what is the best terminal emulation to use with the ST-6000. The 6000 has 5-bit Baudot i/o, so normal terminal emulations that use ASCII aren't much use. I spent some time surfing the net to find something, but everything I find is for more modern devices like the MFJ, the KAM, etc."

Any suggestions?

Bob, while it may look like you have come up against planned obsolescence, those of us who grew up using World War II equipment 20 or 30 years after the fact know that such does not exist in amateur radio. That HAL demodulator is a fine unit, and should do just fine in service once again. One program to start with is TRTY, which is on the first disk of the RTTY Loop Software Collection. At the end of this column, I'll detail how to obtain these programs.

This program is an MS-DOS-based RTTY program which can also handle packet with a TNC. With a plain terminal unit, the HAL series being prime examples, this program should perform admirably to enable both

ASCII and Baudot communication. I would be interested in hearing how well this works out for you on the air.

Of course, if you have a multi-mode controller, there is always a question about that one. Greg N8TDL writes:

"I have a PK232. What is the best software to buy for Windows 95?"

Along with the XPWare software discussed last month, you might take a look at the newest version of PaketPet. Now in version 3.2, this program from Chuck Harrington runs under Windows 3.1, 95, and NT; along with OS/2, and virtually all hardware TNCs, including the PK-232. Chuck passes along some of the following features:

"Point & Click Interface to Packet Mailboxes. Mail Window passively collects message headers, then left click to read, right to reply! Automatically log mail/traffic sent! Automatically format message line length, insert signature file, spellcheck and send! Integrated 90,000 word Spelling Checker. Three integrated text editors. Signature/Forms files supported. Restartable Yapp and text file transfers supported.

"TNC Settings Editor Dialog Box to display/edit your TNC's settings! ANSI color graphics and sound support. Written in high

performance C language. Integrated database listbox to save your packet/Internet addresses."

Fig. 1 shows the display of PaketPet, with many of the features enabled. You can get a copy of the program via the RTTY Loop Download Page, or on Chuck Harrington's page at:

<http://www.gate.net/~paketpet/>

Either way, having obtained the shareware version, registration to a full package is easy and quick.

When it comes to checking on the RTTY Loop Home Page, pay attention to the details, please! I won't name names, to spare anyone embarrassment, but I received an E-mail saying:

"I'm not having any luck with the web URL that goes like this:
www.2.ari.net/ajr/rtty/

"Got it from a friend of mine and maybe he looked at it without his glasses on! I'm a born again RTTY nut from the old days, I am afraid to say. I like the smell of my 28 machine running. I am interested in any DOS type software for my PC and web pages or reflectors on the subject.

"I guess I need to get off my butt and subscribe to 73 again. Did for over 20 years and then stopped with a job change several years ago. I am just now settled down and getting back in the swing."

Last things first: Yes, by all means, subscribe to 73! There are no other amateur magazines on the cutting edge, with the freshness, or with this column; not to mention old Never Say Die! As soon as you finish reading this

column, rip out that subscription card and mail it in.

As to the website address, this shows just how critical these things are. There is a colon in there that does not belong. The correct address, with the http: prefix, is:

<http://www.2.ari.net/ajr/rtty/>

Another thing to note in many web addresses is case. With the Unix conventions used on the Internet, upper and lower case are different. In this case, "RTTY" and "rtty" are different, as would be "Software.html" and "software.html." Be careful, and type web addresses exactly as given!

Once you find the page, though, you will find a library of old "RTTY Loop" columns, many links to a variety of amateur radio websites, programs to download, and a listing of all the software available in the RTTY Loop Software Collection. Now, all of the programs in the collection are not online, primarily because I do not have enough space on my web server to put all 20+ Mb of programs up there. I do link to those available online, elsewhere, though, and have put several up in rotation that many have requested. I also can E-mail individual programs as requested by individuals. But, if you want to get the collection, or parts of it, which now numbers over a dozen disks, the simplest way is to either download the index listing, or, if you are not online, send a self-addressed, stamped envelope to the above address and I'll send you a copy of the listing. Then, decide on which disks you want, and send me a 3.5 inch, high density blank disk, US \$2, and a stamped, self-addressed disk mailer for each collection desired. So, for five of the disks, you would send five disks, \$10, and a mailer or mailers with postage and capacity sufficient to return the materials to you.

As well as providing a source of programs, I look forward to your comments, questions, criticisms and suggestions. Please send them to me via snailmail at the above address, or electronically at ajr@ari.net, MarcWA3AJR on AOL, or 75036,2501 on CompuServe.

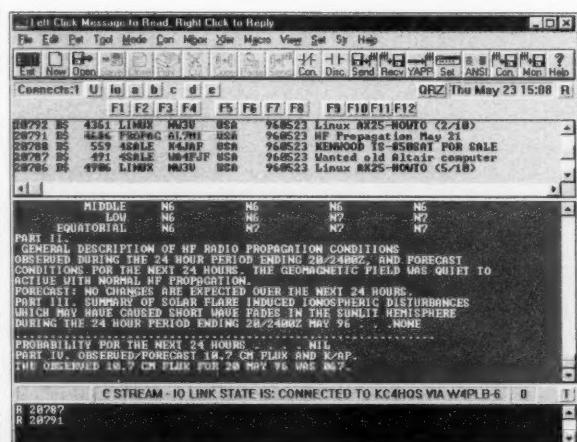


Fig. 1. PaketPet display.

CARR'S CORNER

Joseph J. Carr K4IPV
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Falls Church VA 22041

Better Ham Software Design? Please?

The only reason I don't refer to myself as a computer geek is that I know the definition of geek (it's a carnival sideshow performer whose act involves biting the heads off small rodents or snakes ... look it up, it's in the dictionary). But I do like computers and computer software. I even teach a class in Visual-Basic 4.0 at our local community college.

What I don't like, however, is computer software that is poorly designed, or which has a poor user interface. And that includes a relatively large percentage of the software written for amateur radio and other radio hobbies.

DOS, by gosh, you're kidding, of course

One pet peeve is MS-DOS software that hasn't been upgraded to Windows yet. Several mini-NEC based antenna design programs, and at least two ionospheric propagation programs, on the market are DOS software. The problem is that DOS software often will not run on Windows machines. As you add software in Windows, it starts taking up space in the lower 640K of memory where DOS resides. If the DOS program is larger than the remaining memory available in the lower 640K, then it won't run (an "out of memory" error is generated).

I've discussed that problem in this column before. The solution is to either use a secondary configuration (as allowed in DOS 6.22) or create your own secondary configuration by messing with substitute config.sys files. But who wants to go to that bother? I want to see an icon on the screen that connects me to my radio program. Double-click it and go. What I don't want to do is mess with multiple configurations of my computer.

Today, the availability of Visual Basic and Visual C makes it

too easy to develop Windows programs for there to be any excuse for selling DOS products.

Interface design problems

Even when people design Windows-based software for hams there is often a profound lack of skill demonstrated by the developer. One of the first things I notice is the human computer interface (HCI). I received one product from a small developer that I declined to review in this column because it was so poorly done. Some defects were obvious (like the hideous background

EXIT button. So, when a number is entered into the textbox, the natural thing for a user to do is hit <ENTER> rather than <TAB> as he intended. So what happens? The computer terminates the program. Sighhhhhh.

Two errors were made in that program interface: 1) setting focus to a control you did not want, and 2) not using the <ENTER> key to navigate from one input textbox to the next. The <TAB> key does not automatically spring to mind when using the program like the <ENTER> key does.

Another gripe came from a program that was obviously written in Visual Basic 4.00 (again, the run-time *.DLL file was present). That program used textboxes to display calculated data (which is fine). The problem was that the

"I want to see an icon on the screen that connects me to my radio program; I don't want to mess with multiple configurations of my computer."

color and the fact that he used a pastel that did not permit clear viewing of the eight-point typefont selected), but others take either a practiced eye or one use of the program (then the defects became really apparent).

That program was written in Visual Basic 3.00 (I could tell because the compressed file VBRUN300.DL_ was present on the distribution diskette—it's the run-time engine for VB 3.0). The program asks the user to input certain data in textbox format, and then it would calculate some neat smoke about antennas for you. Wonderful. It even worked.

But the author of the program did not realize that, unless he intentionally changes the order, the first command button laid down on the screen at design time is the one that receives focus when the program executes. Focus means that the button is outlined in darker grey, and will respond as if the mouse was clicked on it by pressing the <ENTER> key on the keyboard. If a command button receives focus like that, then it should be the command button that initiates the preferred default action. Instead, he focused his

author did not lock the display-only textboxes. This means that the textboxes could be altered by the user even though the program did not call for it. In VB 3.00 one had to manipulate the Windows API to lock textboxes, but in VB 4.00 it's a simple matter of checking the Locked property as TRUE ... so there's no excuse not to lock the box.

I've also seen problems in programs that cause the thing to bomb out. For example, one program from a source in the UK allows the user to go forward to the next step even if the current step is incorrect. This program calculated the length of antenna elements given certain input parameters. One of the parameters was frequency of operation (F). If a user enters 7150 for the frequency in kilohertz (a legal entry in that program), then the correct answer is produced. But if the user accidentally enters 7110 by striking the t key rather than 5, then the resulting numerical value becomes zero when the program does its calculations. Guess what that does when F is in the denominator? A divide-by-zero error terminates the program.

The correct way to handle that situation is to provide a means for preventing the user from going forward until the correct entry is made in each inputbox or textbox used for input gathering. Several approaches to this problem are available, so there's no excuse not to do it.

Also, error-handling code should be built into the software in order to trap as many errors as possible. The program might have to terminate gracefully (rather than bomb out), or the error might be user correctable (like entering a valid number for F). Error handling is part of good programming, but seems lacking in much ham software.

User interfaces for programs are what the user sees on the screen. These should be designed according to the UFA principle: Usability, Functionality, and Aesthetic. Usability means that the user can learn to use the program very rapidly. To the maximum extent possible, the operation of the program should be self-explanatory. Functionality means that everything the user needs is available on the screen, or can be reached with simple navigation through screens and menus. It also means that two functional items, or bits of information, that are needed at the same time should be on the same screen. Getting lost in the menu structure should not be possible. The aesthetics of the interface come dead last, but that does not mean that they are unimportant. The screen should be pleasing to view by most people (and that includes using neutral colors), and should be well laid out.

Wherever possible, the standard Windows approach to screen design should be followed. Have you noticed that a lot of Windows application programs look and operate similarly, even though they do completely different things? An advantage of following the usual designs is that the user finds it easier to intuit how the program works. After all, when he or she sees File in the left-hand corner of the Menu Bar, it is obvious what will be found there, and those items should always work the same as in other Windows-based programs.

Color usage

Color pollution is the best label I can think of for many programs I've seen. Color should be used wisely and sparingly on a screen. Color can reasonably be used to divide the screen into different task areas or different types of data. But too many colors on a screen increases the visual search time required to figure out what to do, and where that function is on the screen. Also, research shows that extensive use of color works better for experienced users of a program than for novice users. So design according to the intended level of the user community.

Programmers, by the way, make lousy testers. Even if they are the smartest people around, they are also too close to the project and too knowledgeable about computers in general to make a typical user. If you develop software for hams or SWLs, then have some of them (who are not geeks in either sense of the word) test it for you.

Consistency

Software programs should operate not only consistent with other Windows programs, and other applications of similar type, but they should also be internally consistent. Internal consistency goes two ways.

First, the user should see the same result from the same action every time it is initiated. Further, every time a follow-on repeat of an action is required it should be done in the same manner as in previous attempts (e.g. entering the frequency should not be done in a textbox one time and an inputbox the next).

Second, the system should respond the same way to user inputs every time they are made. In teaching the Visual Basic class I noticed several students who would fail to clear variables and certain input features, and so would create errors because the system thought that something else was intended. Computers are terribly ignorant; they do exactly, precisely what you tell them to do (not what you intended them to do, which may be different).

One good approach to design is to use what the HCI textbooks call forcing functions. These are design

features that prevent the program from continuing further until the user input error is corrected. Examples of forcing functions fall into four groups:

Gagging. Prevent incorrect input by using strategies such as keyboard lockout or numeric-only checkers.

Warning. Display a message box or warning label when an error is made. Message boxes should include a suitable set of alternative actions that correct the error.

Do Nothing. This strategy keeps the program from doing anything further until the error is corrected.

Self-Correction. When an error is made the program detects and corrects the error, relying on default values. This may be the most dangerous approach because you may have to correctly guess which defaults are the ones intended.

Mea culpa

I don't want to hold myself out as a supreme expert on software or interface design, or somehow better than others. I've made most of these errors myself—but I've also learned. My software is not perfect, by any means, but at least I've learned these lessons ... and recommend them to others.

Conclusion

Sorry to dump on you folks with my pet peeve this month, but it is an irritant that I suspect afflicts many users of ham radio software (indeed, all software). Good design will make a product look, feel and work better. A lot more can be said about the subject, but I've used up my allotment of space for this time. Perhaps sometime in the future we will return to it. Perhaps. But if the makers of ham radio software get the message, then it won't be necessary. Just remember one thing: The amateur in Amateur Radio only means we do radio for fun, not for money. That does not imply that amateurish products are acceptable in our marketplace. Amen?

Connections...

I can be reached via snail mail at P.O. Box 1099, Falls Church, VA 22041, or via Internet E-mail at carrij@aol.com.

75

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The AMSAT Annual Meeting

The 1996 AMSAT Annual Meeting and Space Symposium was held November 8-10 in Tucson, Arizona. Over 250 satellite enthusiasts listened to dozens of presentations and visited the Kitt Peak National Observatory and National Solar Observatory. For all participants it was a fantastic weekend. With the launch of the largest and most complex amateur satellite only months away, the symposium focus was on the status of the Phase 3D project.

Friday

This year the AMSAT Space Symposium began Friday morning with a presentation by Dr. Helen Reed, Director of the ASUSat lab. ASUSat stands for the Arizona State University Satellite. Work is underway to build a 10-pound satellite to be launched as a piggyback payload on a Pegasus rocket. The satellite is designed to carry a GPS (Global Positioning System) receiver, an earth-imaging experiment and a Mode "J" (2 meters up and 70 cm down) analog and digital transponder system. Launch is scheduled for spring 1997.

SEDSAT Project Manager Dennis Wingo KD4ETA brought everyone up to date on the status of the SEDSAT program. SEDSAT-1 is a microsat-class satellite that will be part of NASA's Small Expendable Deployer System (SEDS). Changes in launch schedules have caused delays with this hamsat. SEDSAT will carry several scientific and amateur radio experiments. The SEDSAT program also has a World Wide Web home page at the URL (Universal Resources Locator), <http://seds.lpl.arizona.edu>.

John Franke WA4WDL described a fascinating hardware

project. John's interest in the Russian Tsikada (pronounced Cicada, like the insect) navigation satellites led to efforts to decode their telemetry signals. He built a dedicated "black box" to decode the 150 MHz FM signals from the satellites and display the time data.

Peter Vekinis KC1QF wrote a paper and made a presentation describing changes to his proposed "Picosat System" of low-earth-orbit amateur satellites. Peter proposes a constellation of Picosats all using VHF and UHF frequencies. Like the Motorola Iridium system of "cellular phone" satellites, the Picosats are to use intersatellite radio links to extend the communications range.

This year's SAREX (Shuttle Amateur Radio EXperiment) talk by Frank Bauer KA3HDO focused on a new program, the Amateur Radio International Space Station (ARISS). Due to the long-term nature of the presence of an in-orbit ham station and the multinational use of the equipment, there are frequency coordination issues and operational aspects to be considered. National groups currently involved include Canada, France, Germany, Great Britain, Italy, Japan, Russia and the United



Photo A. Dr. Tom Clark W3IWI discussed many topics, including his "Totally Accurate Clock" and the problems with Mexico OSCAR 30.

States. Goals include organization of all amateur radio manned space flight efforts, support, maintenance and upgrade of current *Mir* and Shuttle amateur radio gear, and the establishment of a single integrated radio system for the International Space Station.

Assi Friedman 4Z7ABA provided the gathering with an update on the Techsat-1 program in Israel. The first Techsat satellite was destroyed due to a launch failure in Russia in 1995. The new version of Techsat is similar to the first with a few upgrades for better digital store-and-forward operation. Two have been built. One will be launched early this year. More information about the family of Techsats can be found on the Internet at the URL <http://www.technion.ac.il/~asronen/techsat/>.

Other Friday afternoon talks included Gould Smith WA4SXM's description of the activities between the European Space Agency and AMSAT, an explanation of "what it takes" to

set up and calibrate a radio telescope for SETI (Search for Extraterrestrial Intelligence), a reception by Dr. Paul Shuch N6TX and a tutorial on spread-spectrum techniques by Phil Karn KA9Q. Phil also presented material on Saturday concerning a high-performance satellite modem.

After dinner the talks continued but with a focus on newcomer topics. Barry Baines WD4ASW got things started with a general tutorial, while Ken Fernandes N2WWD discussed the fundamentals of Keplerian elements. The evening concluded around 10 p.m. with Doug Quagliana KA2UPW and his simple, yet effective, mobile low-power station description. Doug brought along some of his antennas and gear to show the attendees.

Saturday

Activities began in earnest at 8 a.m. AMSAT President Bill

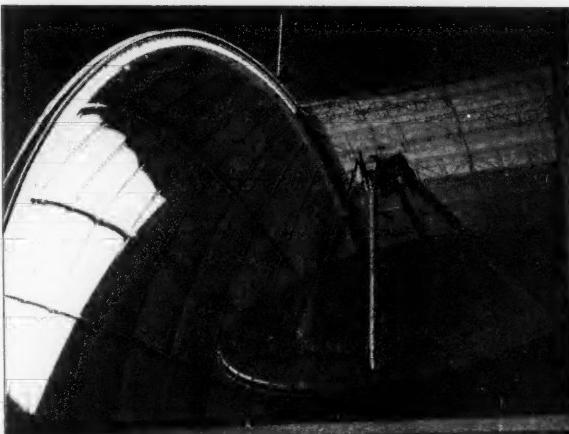


Photo B. Most symposium attendees went on the Kitt Peak tour. This 12 meter dish at the National Radio Astronomy Observatory has been used above 300 GHz.

Tynan W3XO gave an official welcome to the symposium participants. Dick Daniels W4PUJ got things started with a Phase 3D construction update. The satellite is in the final stages of integration in the Orlando (Florida) lab. Launch is scheduled for April on

the second Ariane 5 rocket from the Kourou, French Guiana, facility. All of the major components are in place and ready to go, with only a few exceptions. Work will continue at an accelerated pace to get everything ready and tested by the end of February.

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Photo C. The 75 meter dish at Kitt Peak is part of the Very Long Baseline Array (VLBA) network of radio telescopes. Those on the tour got a close-in look at all of the systems. The dish is used at frequencies up to 47 GHz.

Bdale Garbee N3EUA has been working on the Phase 3D GPS (Global Positioning System) receiver system. The original design has been scrapped and two new GPS receivers are being provided by NASA at the Goddard Space Flight Center. The purpose of the GPS receivers is to determine the viability of using GPS for orbit and attitude determination at orbits above the GPS constellation.

An update on the digital systems of Phase 3D was provided by Chuck Green NØADI. The system is called RUDAK. This is a German acronym for *Renergiver Umsetzer fur Digitale Amateurfunk Kommunikation*. This roughly translates to Regenerative Transponder for Digital Amateur Radio Communication. The program has a long history from its beginnings over a decade ago in Munich, Germany. The latest version will start its operational life as an orbiting packet-based digital communications system. Later in the mission it will be reprogrammed for new and faster digital modes. Development for this new version of RUDAK has been based in Tucson, Arizona, and includes many members of TAPR (Tucson Amateur Packet Radio Corporation).

A Saturday talk by Dr. Tom Clark W3IWI (**Photo A**) discussed extremely accurate time signals available via the GPS (Global Positioning System) satellites. Tom's device, called the Totally Accurate Clock, provides an interface between a small GPS

receiver and a computer. The resulting timing signals are accurate to intervals of less than a microsecond.

An afternoon presentation by Ed Krome KA9LNV covered a Phase 3D-related topic. Ed presented "The View From Below: Thoughts on Phase 3D Ground Station Requirements." Due to the many ham bands covered by Phase 3D, the nature of the final orbit and the power output of the satellite's transmitters, working Phase 3D from the ground will be quite different from current satellites. Ed proposed the use of small microwave dishes with multiple concentric or offset feeds and small VHF/UHF yagis all mounted on a single boom. The use of mast-mounted downconverters and transmitconverters was proposed for modifying current ground-based systems to operate new modes of Phase 3D.

Saturday was not all Phase 3D. Past AMSAT board member Harry Yoneda JA1ANG provided an update on the operation of Fuji-OSCAR-29. AMSAT President Bill Tynan W3XO presented some thoughts on possible projects beyond Phase 3D. AMSAT Vice President of International Affairs Ray Soifer W2RS gave his observations on the "Amateur Satellite Service in 1996," while Richard Limebear G3RWL expressed his concern for the future of amateur satellites.

Prior to the banquet, Bill Tynan hosted the annual AMSAT meeting with members of the Board of Directors and AMSAT officers on stage. This is always a great opportunity for AMSAT members to ask questions of a group that is only together in one place once a year.

Following the meeting and some time out for "attitude adjustment," the yearly banquet, awards presentation and prize drawing were held. The banquet speaker was Darrel Emerson AA7FV. Darrel is in charge of the 12 meter radio telescope on Kitt Peak near Tucson. His discussion of radio astronomy and the pioneers that opened up this fascinating field was quite thought-provoking. It was also a preparation for the incredible tour scheduled for Sunday.

At the awards presentation many AMSAT supporters were honored and a special plaque was presented to the American Radio Relay League for their work to provide over \$500,000 for the Phase 3D program. After the awards, prizes finished the evening. They ranged from books, T-shirts and maps to gear from SSB Electronics, an antenna system from Larsen, a mobile transceiver from Kenwood and an all-mode VHF/UHF transceiver from ICOM.

Sunday

Following the Field Operations Breakfast at 7:30 a.m., everyone took off for Kitt Peak in chartered buses. For satellite enthusiasts it's hard to imagine anything more exciting than the close-up tour of the Phase 3D facility that occurred at the 1995 AMSAT Space Symposium. Kitt Peak may not have any satellites to look at, but the technology, electronics and giant dishes of the National Radio Astronomy Observatory were incredibly impressive. The AMSAT Board of Directors meeting was postponed so that everyone could attend.

The tour included the 12 meter radio telescope (good up to 300 GHz) and the 75 meter radio telescope (good up to 47 GHz). The 75 meter dish is part of a global network of identical

dishes that are used together to create the VLBA (Very Long Baseline Array). Tom Clark W3IWI provided details about the coordination of observations between locations.

A walk through of the 12 meter dish control room and a "hard-hat" climb through the feedline room at the back of the 75 meter dish provided real perspective to the show. The clear air, high altitude and incredible view in all directions are hard to describe when experienced from the support structure of a giant radio telescope.

The tour didn't end with the radio telescopes. The Symposium attendees also got a chance to view the Mayall 4 meter optical telescope, the 2.1 meter telescope and the incredible National Solar Observatory. The solar "telescope" is 500 feet long, mostly underground, and looks like a giant temple built by an ancient or alien civilization. It is used to study the complex surface motions of the sun in order to gain a better understanding of the interior.

After the all-day tour, Bill Tynan W3XO started the AMSAT Board of Directors' meeting, which lasted through mid-Monday with a few breaks for food and sleep. The agenda covered many items, including publications, SAREX, ARISS, long-range planning, new satellites and the budget. The Phase 3D program was again the main topic. AMSAT still has a significant challenge ahead to pay its part of Phase 3D and maintain other activities. Launch date slippages cost money, just to keep testing and other contract work going until launch.

Toronto, Canada, is the site for the 1997 meeting. It is sure to be a fascinating event since Phase-3D will be in orbit by then. Watch for more information on the AMSAT Web page at <http://www.amsat.org>.

Copies of the "Proceedings" of the symposium are available from AMSAT or the ARRL. The softcover book is 8 1/2" by 11", 232 pages. It's well worth the cover price of \$12. AMSAT can be contacted at 1-301-589-6062 for details on shipping charges.

HAM TO HAM

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Just a reminder to keep the "Ham To Ham" column in mind whenever you run into an interesting solution to a problem in your pursuit of amateur radio. I need lots more input to keep the column lively and interesting. Any idea, suggestion, tip or solution is fair game, as long as it has applications to the hobbies of electronics and ham radio. We've all discovered unique approaches and resolutions to our common problems, and "Ham To Ham" is the ready forum for sharing them with other 73 readers. Just jot down your ideas and send them to the address above; I'll let you know if I can use them and roughly when they'll appear. Include an informal sketch if you feel that would help explain your suggestion, and a short text (handwritten or typed), and I'll take it from there. I'll put it into the tone of wording that I've been using for the column and redraw the illustration if needed, so don't let formality hold you back. Now to this month's ideas.

**"By merely typing
'dir,' on an infected
disk, you can
spread the virus to
your hard drive!"**

Viral protection

From Terry Huckleberry
N5FYI: Protecting your computer from an insidious viral attack: "Most virus infections occur as a result of people exchanging diskettes. The best mainline protection against infection is therefore the pre-screening of any and all incoming disks. Even before reading the disk's directory!

"Most viruses also lie dormant for a period of time, before self-activating and causing any critical damage to your system. During its dormant stage, however, the virus can be reproducing, spreading itself into other areas of your system,

undetected. The sinister virus programmers aren't looking for instant destruction, but rather for the widespread latent destruction made possible by waiting patiently to attack. This is one of the features that can make the more sophisticated viruses so devastating. Early discovery and elimination ends the virus's life-cycle.

The solution? Virus-scan everything that you import into your computer before doing anything with that program. Scan all outside floppies before even reading their directories. A friend of mine recently downloaded a virus scanner and found that there was a virus in the zip file of the virus scanner itself! Scan each installation of every program or data file; in most cases, you can stop the viral spread beyond the initial file that contains the disease if you're consistent with this policy.

Any virus detected should be considered dangerous!

A further warning: Even factory-sealed program disks can't be considered absolutely virus-free, and due to the way in which files are often packaged, a program loaded directly from a factory-boxed disk can't usually be fully virus-scanned until it's installed on your system. The best policy then is to re-scan for viruses after each installation (and before actually running the program) on any newly installed outside programs. This may seem extreme to some, but so is the damage that can occur from an infected outside disk."

Moderator's note: Terry brings up some important points. It's a shame that we even have to worry about things like this, but we've all heard the horror stories of intentional viruses. As programming techniques and packaging alternatives become more sophisticated, it may be less likely that viruses will be able to spread as readily as they do today, but until that time, it's best to stick with the safest approach. There are numerous virus scanning programs available today, and Terry mentioned that

he's had good results with F-Pro® and Thunderbyte® virus scanners, to name just two. Additionally, make sure that your anti-virus program is a recently updated version; as the anti-virus scanners become more adept at ferreting out the culprits, the virus programmers often counter with sneakier viruses, reminiscent of the old nuclear "Cold War" days!

From Rich Measures AG6K:

Some tips for dispelling the equalizing resistor myth, and straightening out some of the confusion surrounding the use of equalizing resistors and capacitors across high voltage diodes: "In days of yore, when silicon diodes were first introduced to the consumer electronics market, the absolute 'need' for equalizing resistors and equalizing capacitors across the newly discovered critters was admitted by virtually everyone. Today, things are a lot different. Silicon rectifier manufacturing technology has come a long way, and inherent similarity from device to device is the norm, not the

exception. So are equalizing resistors and equalizing capacitors across the current offering of silicon rectifiers really needed now?

"No. In fact, they can actually cause problems of their own in the series high-voltage power supply circuits found in most amateur HF linear amplifiers. Here's why: The little 1/2 watt carbon composition resistors normally used in this service were never designed to handle more than about 350 volts maximum DC across their relatively small carbon elements; most high voltage diode stacks used in modern linear are expected to carry twice that voltage, or more, safely. So, over time, internal stresses within these 350 volt resistors can eventually cause one or more to break down—usually by decreasing gradually in value—and then the domino effect takes over. In short, one or more resistors fail, putting that much more strain on the rest, and eventually causing catastrophic failure of otherwise perfectly good parts in a series circuit such as the one described.

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GE DELTA, 100W, Syn, \$199*	GE DELTA, 100W, Syn \$199
MICOR, 100W, Xtal, \$99	MICOR, 100W, Xtal, \$125
MITREK, 100W, Xtal, \$125	MITREK, 100W, Xtal, \$249*

406 - 420 Mhz	450 - 470
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"Instead of using equalizing resistors and capacitors these days, just make sure that the total PIV of the entire silicon rectifier stack will handle the total peak voltage to be expected, with substantial safety margin to spare, and leave it at that."

"One factor that should be recognized, however, is that all of the rectifiers in a series-connected circuit should have similar junction capacitances—using the same type number rectifiers will normally assure this. If they're not equal, then the reverse-voltage across the lower capacitance rectifiers will tend to be excessive, because smaller capacitors charge faster than bigger capacitors. It's a good idea, therefore, if rectifier types must be mixed in a series circuit, to equalize with disc capacitors. If some 6 amp rectifiers are used as replacements in a circuit using 1 amp devices—assuming that's all that the repairperson has on hand—then a .01 μ F disc cap across each device may help, but only because of the wide variation between those 1 amp and 6 amp rectifier natural junction capacitances. Again, there's no need to add 'equalizing' caps and resistors in a series circuit having all the same part numbers—and it can even do harm."

"Here's one thing of interest that I once ran into, though it's not by any means a common problem. I encountered a production run of silicon rectifiers that apparently had poor spot-welds inside the rectifier casing itself. Internal heating and cooling eventually caused these welds to break, completely opening the rectifier from current flow—not a healthy condition in a series HV circuit. If one of the capacitors in the circuit is not being charged by its respective rectifier, then reverse current can be forced through it, and the results are noisy and messy. If you ever run into just one open silicon rectifier in a series HV circuit, don't take chances. For the 10 cent price of a rectifier today, replace all of them, just in case it was the product of a poor manufacturing run. The normal failure mode for these devices is a dead short, caused by too much forward or reverse current, not

an open. Be forewarned. Be suspicious."

Power supply tips

From Peter Albright AA2AD:

Some tips and techniques on practical linear power supply troubleshooting. "Linear (not 'switching') power supplies are sometimes the easiest of the many circuits to be found in ham transceivers to troubleshoot, and they're also often the most prone to failure due to the demands imposed upon them. Quite often, diagnosis of other circuit failures can be traced to incorrectly operating power supply circuitry, so this part of the chain should always be checked for proper operating parameters before going into the more complex circuitry.

"Most power supplies can be thought of as containing five basic blocks: 1) the input interface block (the input line cord, protection circuit, power transformer, etc.); 2) the rectifier block (where AC is converted into pulsating DC); 3) the filter block (where the pulsating DC is converted into smooth DC); 4) the regulator block (where output voltage stability is determined); and 5.) the output interface block (where current limiting resistors and/or wires and PC board traces carry the supply voltage to other stages of the transceiver). By thinking of the power supply in terms of individual blocks, it's often easier to isolate problems in the power supply using the logical steps of elimination.

"The first analysis of any suspected power supply problem can begin with the unit's cover in place. Is the line cord in good condition, is the fuse intact (if accessible from the outside), what (if anything) unusual was noticed at the moment of failure, was anything spilled on the unit or did a voltage surge or lightning strike occur? Was there any smoke or perhaps unusual noise associated with the failure? All of these 'external' clues can help lead us to the eventual solution to the problem. Always look first for the obvious, it can save countless hours of needless troubleshooting time (an intermittent AC line cord or fuse holder, for instance).

"Once the cover is actually removed, leave the equipment unplugged and begin your visual

inspection. Do any parts appear to be overheated? The transformer should be carefully inspected for signs of excessive heat (and odor associated with hot varnish), resistors should not appear darkened or discolored, electrolytic capacitors should not be leaking or bulging and all wiring or printed-circuit board traces should be free of signs of excessive heat or thermal stress. Do the solder connections look clean and bright and are component leads clipped off so that they won't short to adjacent solder pads? Checking the power supply circuitry visually can save a great deal of time and effort if done systematically and with care. Anything at all that 'appears' suspect, should be removed and checked (or substituted) before going on.

"Now we're ready for the power-on test, but be very careful—most power supply circuits can have lethal voltages present when operating, at least in the area of the primary fuse and the AC line circuitry. Always know where these points are before putting your hand inside of the chassis and proceeding with any voltage tests.

"Having a schematic diagram can be a big help at this point. Check the diagram and locate the output regulator or regulators, then measure their input and output voltages with respect to ground. If you don't find the expected voltages (which are generally indicated on the diagram), then the problem could be in either direction, i.e. either the correct voltage isn't being applied to the regulator's input, or the regulator is bad or the output voltage is being dragged down by a higher-than-usual current demand somewhere in the circuitry that's being fed by that regulator. If you can open a link to that subsequent circuitry (by removing one end of a resistor, a steering diode or simply removing a wire), then you can eliminate the circuitry being supplied power as the source of the problem.

"If you don't have a schematic diagram or other technical information, all isn't lost; often you can assume that the normal voltage reading obtained with a voltmeter across each of the large electrolytic filter capacitors will be about 80% of the voltage marked on the capacitors. It's not exact, but often enough

to determine proper operation at least. Many times, voltage regulator ICs will have their regulated output voltage coded into the part number, such as a 7805 is a 5 volt regulator and a 7812 is a 12 volt device. Again, by working back through the various blocks, you can often tell if a reading 'seems' normal or if it's 'out of the ballpark' altogether. Experience helps, but experience is only gained through actual troubleshooting practice. Chances are, you'll do better than you think you're able to do, just by using these logical steps and thinking of the circuits in terms of the five basic blocks mentioned earlier. Why not give it a try?"

Moderator's note: Pete does a good job of outlining some time-honored procedures for power supply troubleshooting. Knowing the normal failure modes of components is also helpful when attacking power supply problems; here are a few:

Fuses always open (badly blackened fuses usually mean a high-current short). Power diodes normally short (smaller signal diodes, LEDs and small zeners usually open). Resistors normally open or change value with overheating. Transformers can open or overlapping turns can short internally (some transformers have internal thermal protectors that can open). Dry capacitors (such as disk capacitors) normally short or become very low-value resistors. Electrolytic capacitors can leak, dry out and lose their capacity to store energy. They can also short, often with dramatic results. Voltage regulator ICs can open, short or change their output parameters (they can also oscillate at times).

Note that these are the normally "expected" failure modes of components in power supply service, others are also possible. I've seen power transformers go up in smoke, high voltage electrolytics explode, regulator ICs blow apart into tiny pieces, resistors sputter and smolder, plastic insulation on wires completely melt away and fuses weld themselves inside of their holders. Power supplies or their feedlines are generally where these sorts of things happen, so any suspect power supply component should be considered for replacement as a precaution.

Cable IDs

From Dave Hyman KBØONF: "Time to start saving those little square plastic closures often found on plastic bread bags; they make nice cable identification tags. A drop of lacquer thinner will remove any printed matter on the tags, and a sharp black permanent marker will allow you to write your own information in its place. They fit nicely on most sizes of cabling found around the average ham shack, but the hole can also be enlarged a bit with a hobby knife if needed. If the tag refuses to stay on a particular cable, try putting a small piece of good quality transparent tape across its split edge."

Moderator's note: Nice idea. Does anyone have any other favorite cable-marker schemes? Here's something to complement any cable marking idea: Instead of trying to put all of the information needed on the tag itself, use a "cable schedule." It's simply a form (make up one and photocopy a bunch of them) that shows a cable's number (such as #100), the type of cable (RG-8X coax), the source (FT-1000MP Antenna Jack), its destination (Linear Amp Input Jack) and its purpose (RF feed from transceiver to linear). A sheet of standard (8-1/2 x 11") paper will easily hold the information needed on 20 or so cables when oriented in the 11" (landscape) direction. A cable schedule allows you to put just a cable number on each end of a cable, rather than trying to describe what the cable's function is on a rather small tag...that's all done on the schedule form sheet instead. The cable schedule form gives more information than would ever be possible otherwise, and permits you to change the function of a cable when redesigning your station—only the entry in the cable schedule form need be changed. We used cable schedules extensively in broadcast installations, considering the cables more or less permanent, and only their functions as changing. Do it in pencil. It's logical and flexible once you've become used to it, but you do have to keep it up to date if it's to be of value.

Cleaning up after a hamfest

From Mark Marholin KE6JJR: "You can often make

those not-so-attractive 'hamfest specials' come back to appearing close to new, by simply mixing some hydrogen peroxide and water as a cleaning agent. Hydrogen peroxide is inexpensive, and can be obtained at any drug store, but it does a nice job of cleaning grit, grime and tobacco smoke stains from a piece of equipment. It also kills bacteria and breaks up organic matter—that might have been an unexpected bonus—with its bubbling or cavitation action. The exact proportions can be arrived at experimentally, but a 50-50 blend is a good place to start, since the typical consumer-available hydrogen peroxide is usually only about 3% strength. Give it a try and see how it works for you. By the way, it's also used as a bleaching agent, so avoid getting any on your clothing."

"Mark's tip is another reason why hydrogen peroxide may deserve a reserved spot on your bench."

Moderator's note: I've kept a bottle of hydrogen peroxide on my workbench for years for applying to small cuts and scrapes on my hands, because of its anti-bacterial properties; an MD friend told me about it long ago. Mark's tip is another reason why hydrogen peroxide may deserve a reserved spot on your bench. I've also found Dow™ foaming bathroom cleaner (available at supermarkets) good for cleaning particularly grimy equipment panels and cases. It too has a cavitation action that breaks away stubborn collected material, but test it first on an out-of-the-way spot to make sure that it's compatible with the paint and silk-screening used on your rig—you don't want to "clean away" important information!

Murphy's Corollary: Explaining something so clearly, and in such detail, that no one could possibly misunderstand it, will inevitably guarantee that someone will.

That wraps up this month's column; does anyone have any ideas on "different" uses for common items such as K9PKM gave us? Send them, or any other ham-related tips, ideas, suggestions or shortcuts to me at the address in the masthead, and I'll share them with the rest of 73's readers. That's our purpose, sharing practical ideas Ham To Ham.

Many thanks to this month's contributors, including:

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QRK . . .
Continued from page 8

Interesting Web Sites

If you have Internet access, and are interested in looking up various callsign information, you may find the following web sites useful:
<http://www.webbuild.com/~ki4hn/vanity.htm>

This site contains the latest information on the issue of "vanity" callsigns. There are files which include listing of all vanity callsigns issued on each day, since about the July time frame. There are also files which contain a collection of all the callsigns issued by call area. The files are updated daily. If you are interested in following the vanity callsign program, this is a good place to look for information.

<http://www.ulair.edu/~hamradio/callsign.html>

This is a page at the University of Arkansas. It has an up-to-date copy of the FCC database. The information at this site is usually only a day older than the information at Gettysburg.

Essentially, this site can serve as an equivalent of the *US Callbook*. Additionally, it has some search capabilities. For example, if you want to look for all the hams with the name of "Higginbotham," the search engine will show there are 48 in the FCC database. Or, if you want to look at all the hams in North Attleboro, the search engine will show there are 74. It shows the number of hams in Attleboro to be 87, including one with a British callsign and two with Japanese callsigns.

Take a peek at either of these web sites if you happen to be "surfing the net":

www.lantz.com/cbs

This URL is a pointer to a site that tracks recent changes. It has a pointer to a US file, and it has pointers to files for each state. It doesn't, however, seem to record recent vanity callsign changes.

www.arrl.org/fcc/fccld.html

This URL is a pointer to a database of the recent FCC database changes. It is said to cover about a six-week period. You can scan this using any call that might have changed in the six-week period. You can query using either the "old" call or the "new" call. This seems to be about the best place to look for "very recent changes."

By Dick WS1H, in "The Chirp 'n' Click," December 1996, the official newsletter of the Sturdy Memorial Hospital ARC.

Ask Kaboom

Your Tech Answer Man

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c/o 73 Magazine
70 Route 202 North
Peterborough NH 03458

Crunch, Crunch!

If you've spent much time around radio gear, you know it can have its share of problems, just like all electronic things. Some of the issues are similar or identical to what you find in camcorders, stereos and the like. Some, though, are peculiar to RF, and are common enough that we have names for them. One of the most often heard complaints is that a radio has the "crunchies." What the heck is that?

A "crunchy" radio is one that transmits a characteristic sound of teeth crunching. OK, it's really just a crackling noise, but it does sound like the transmitting operator is munching on popcorn while carrying on a QSO. Of course, perhaps he or she is doing exactly that! Such an obvious explanation aside, it's safe to assume the radio itself is the source of the crunching noise, and some remedy must be applied. So: What causes crunching noises in a transmitter?

Pick one

Unfortunately, there's no single cause. While it might seem intuitive that crunching sounds are generated by bad connections (and many are), the kinds and locations of those connections can be surprisingly difficult to pin down. Also, some crunchies are caused by effects not related to bad connections at all! So, let's take a look at the crunchies and how you can get rid of them.

Is it me?

Before you go trying to solve your rig's crunching problems, be sure it really is your radio that's doing the crunching! Repeaters, themselves, are quite prone to the crunchies, and many operators

think their radios are the problem when the real trouble is up on a hill, miles away. Often, the listener reporting the sound is no help; it's amazing how many people forget they're operating through repeaters and attribute everything they hear to the other op's rig.

Easy crunch

Some cases of the crunchies are easily solved. If your microphone cable has a broken wire inside, it can still work because the two ends are touching each other. As you move it around, though, it'll cause massive crunchies. I've heard plenty of mobile rigs doing that, and have had a few myself. Usually, the cable damage occurs

from bad crunchies to making the radio try to transmit and receive at the same time! It pays to carefully squeeze the PTT while listening to another rig.

The other end

An often-overlooked, but common, cause of crunchies is bad antenna connections. I remember one case in which the mobile rig's SO-239 connector had accumulated greenish gunk inside, presumably because the radio was on the floor of the car and had seen plenty of rain, snow and moisture. The result was poor contact with the antenna plug, and a bad case of the ol' crunchies. That kind of antenna problem can wreck the final amp module, too, because the SWR goes up and down quickly and constantly. Luckily, no damage was done.

Naturally, bad connections to the power supply can cause crunchies. Although the problem

"Always check those BNCs; it makes sense to expect trouble there."

right near the plug, although sometimes it's at the mike itself. Often, you can just cut the plug off and reattach it after snipping off an inch or so of cable. Before you do, though, wiggle the cable while transmitting and listening on another rig, to be sure you've found the bad spot.

Another common cause of crunchies is the PTT switch. Older rigs used relays (themselves a serious crunchiness offender) to switch between transmit and receive. The relay didn't care about the exact resistance of the PTT switch, as long as it was low enough to provide sufficient current for pulling in the relay. With today's solid-state switching, it's another story. In most of today's rigs, the PTT line is an input to the microprocessor. Like the relay, the micro doesn't really care whether the switch has some resistance. However, that line often also does some other things, and, when the switch's resistance goes up, it can make the radio go haywire. I've seen flaky PTT switches cause everything

can be at a terminal or even a fuse, it doesn't seem to happen much in mobiles and bases. HT battery tracks, on the other hand, do it all the time. Often, a good cleaning with a pencil eraser will do wonders—and that brings us to the ultimate crunch machine:

The ubiquitous HT

Although lots of different kinds of rigs can crunch, the ones I hear most often, and the ones I've most commonly had to fix, are handhelds. Heck, I've seen brand-new HTs that were crunchy right out of the box. Why are HTs so prone to this problem? There are several reasons. First, the RF output is usually via rubber duck antenna, which puts a great deal of RF right back into the walkie. That can lead to crunchies for reasons I'll shortly explain. Second, HTs are very small constructs, with sensitive stages quite close to each other, shielded only by small amounts of thin metal. Finally, handhelds take a lot of physical abuse, due to their being carried around all the time.

Shield me

When there's lots of RF pounding on the shields of sensitive circuits, as there often is in a rubber-duck HT, those shields had better be nice and tight! Even a cold solder joint can exhibit enough rectifying ability to cause RF feedback. Heck, even the unsoldered edges of small shield cans are capable of spreading the RF around unevenly enough that there's some potential between various parts of the shield. That makes the shield into a radiator, and it radiates RF right into the circuits it's supposed to shield. Now, if the exact properties of that shield vary as you squeeze or move the rig, what do you get? Yup, the crunchies!

The average modern walkie is constructed in two halves, usually with a ribbon connector between them. That's in sharp contrast to the old style of construction, which had one big board in the middle of the frame, and perhaps a small microprocessor board behind the keypad. The old way was better in one respect: It rarely led to the crunchies, because the grounds were all tied to the same frame. The newer, split style means that, right off, there are two grounds, one on each side. Remember, at VHF and UHF, it only takes a fraction of an inch for a ground plane to become an inductor, and that spells trouble with a capital "C." Most HTs have a metal tongue that extends from one side to the other and is intended to connect the two grounds. Does it work? Well, kind of. When the rig is new and clean, it works pretty well, but as the handheld ages and a little grime gets in there, and the tongue's spring tension relaxes, the integrity of that all-important connection gets questionable. You squeeze the rig, causing the tongue to rub slightly against its contact on the opposite side of the radio, and it makes that characteristic sound. The rig goes "crunch."

Mostly on TX

Why does this problem affect transmitting so much more than receiving? On receive, there's no

big source of RF against which the shields have to protect. Sure, the various internal oscillators make some noise, but not at the level of watts of power! Shielding and grounding problems that aren't even *noticeable* on receive can be troublesome on transmit. I remember one stubborn case of the crunchies in a brand-new HT that turned out to be a cold solder joint on one of the four corners of the shield over the VFO circuit. The rig worked fine on receive but was intolerably crunchy on transmit. As it turns out, VFO and PLL circuitry is particularly sensitive to shielding problems. Heck, this radio had three of the shield's four corners soldered just fine, and it still didn't work right! If you have a crunchy rig and the obvious solutions aren't working, check those shields on the circuit board. You can usually spot the ones over sensitive circuitry because there'll be a hole for adjusting a coil or trim cap.

I had another crunchy handheld. I was sure had this problem. I soldered *everything* I could find, and it still crunched. I even soldered parts of the frame together, because they were held only by tiny rivets, and I thought perhaps that was the problem. No dice. No matter where I pressed, the rig crunched. It finally turned out to be a dirty BNC antenna connector! I cleaned the hole on top with a tiny rolled-up piece of paper soaked in contact cleaner, and the problem went away. From now on, I'll always check those BNCs. After all, the contact area is pretty small, and it's exposed to lots of environmental stuff like dirt, smoke and moisture, so it makes sense to expect trouble there.

By the way, HF rigs can be crunchy, too, often for the same reasons as VHF/UHF radios. Some cases of HF crunching, though, are caused by simple RF feedback into the microphone amplifier circuit, so always check for that by transmitting into a dummy load before assuming the radio has a real problem.

Well, I think we've crunched enough for one month. Next time, we'll look into something else. Until then, 73 de KB1UM.

NEVER SAY DIE

Continued from page 43

and not one like 99.99% of the magazines you read, but like mine. What would you write about? Try sitting down at your word processor and let's see what you can come up with.

Have you had an exciting adventure in amateur radio? Have you read a book that you think everyone really should know about? If you haven't had any exciting amateur radio adventures, why the hell not? What's wrong with you? The doors to adventure are right there in front of you at every turn. Are you blind? And if you haven't read a truly fantastic book recently, why not?

Have you done anything, learned anything, built anything, which might be of interest to the 73 readers? If so, start writing. If not, get a life. It doesn't have to cost a lot to get on packet or our ham satellites. Heck, a DXpedition to St. Pierre or Anguilla doesn't cost much, and will give you things to write (and even talk) about for years.

Or maybe you're a CW fanatic and can tell us how you went about learning to copy the code at 50 wpm? Or faster? If you wanted to, I'll bet you could learn to copy 50 wpm in two or three weeks and have the time of your life. But then you might want to get Congress to pass a law making everyone else learn to copy 50 wpm. Or become an ARRL Director. Or both.

You're an editor. You have a deadline coming up in a couple of days. What are you going to write about? Now get busy. If you can get me excited enough, I'll publish it. Oh yes, don't forget to send both hard copy and a disk. And please don't forget to use your spell checker.

I'll tell you what. If I find I'm getting more good stuff than I can fit into 73, I'll reprint your editorials and send copies to the editors of the several dozen ham club newsletters I'm getting. Many of 'em are in pathetic need of interesting material.

Once you get the hang of writing you'll be surprised at how easily the ideas come. I've never had a time when I sat down to my typewriter or word processor and was stumped for something to write about. No dry spells. Worse, I've gotten way ahead. A few months ago I published a

Continued on page 69

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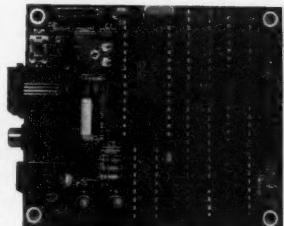
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Radio Direction Finding

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Build a multiple polarization quad

Cubical quads are the most popular antennas for VHF and UHF radio direction finding (RDF) in many places around the country, including Southern California. One reason why you see so many quads on vehicles at our hidden transmitter hunts (T-hunts) is that quads can easily match the polarization of the hidden signal. This can make the difference between success and failure in some cases.

Let's say that the signal you're tracking has horizontal polarization, but you are using a vertically-polarized RDF system¹. This cross-polarized condition means that the direct incoming signal is between 14 and 25 dB weaker in your receiver, reducing your effective RDF range. Worse yet, any signals from the hider that propagate to you by reflection from nearby buildings, intermediate hills, and distant mountains undergo a polarization shift. That makes them appear stronger, relative to the direct signal, than they would if your antenna had horizontal polarization. As a result, you might end up chasing reflected signals throughout the entire transmitter hunt, never getting accurate bearings on the direct signal.

With a simple slip joint at the boom-to-mast junction, a 2 meter quad is easily changed from horizontal to vertical polarization or to any other linear polarization angle. By adjusting your quad's polarization to maximize signal strength at the start of each T-hunt, you can avoid the problems of hunting cross-polarized signals.

The slip joint method has a few drawbacks. Sometimes it's not easy to tell for sure what polarization the hider is using, so you must check again occasionally as you progress toward the T. That's

with separate feedlines and a switchbox to select six polarization modes. Many T-hunters, including your columnist, prefer quads to yagis because they are more compact. A typical mobile-mounted quad provides a better RDF pattern than a yagi of the same size. Hence, I have considered designing and building a multiple-polarization RDF quad for a long time. A recent inquiry by KD6IFZ on the Internet T-hunting mailing list motivated me to move the project onto the front burner.

One quad, two feedlines

While separate driven elements for horizontal and vertical polarization on one quad could probably be made to work, a more

Vertically-polarized signals induce currents within the loop also, but magnitude and phases are such that they cancel out at point A.

RF current from the transmitter is highest at point A. There is another transmitting current maximum at point C. At points B and D, current is at a minimum.

Theoretically in a perfect quad, loop current would be zero at these points. In a practical beam, it is less than 1 percent of the maximum.

If there is indeed no current at point D, why can't we just break the loop there, as in Fig. 1(b)? You can! If you have antenna analysis software such as ELNEC², try this as an "exercise for the reader." Insert a very high value resistive load at point D in the DE of your favorite diamond quad model for any band. If the quad is symmetrical, then the resonant frequency, pattern and feed point impedance will show very little change.

With the added break, we have the driven element of Fig. 1(b). Feeding it at point A gives horizontal polarization, while feeding it at D gives vertical polarization. Both modes can be handled by the quad simultaneously. So why not just hook a feedline to each point and switch from one to another at the receiver, as in Fig. 1(c)?

Whoa! Breaking the loop and adding a 50-ohm load at a current minimum will not affect it, but adding an unbalanced feedline certainly will. The braid of the coax becomes part of the antenna. As another ELNEC exercise, hang a long wire (representing the

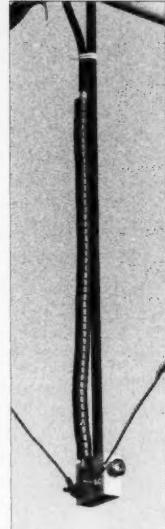


Photo A. One of the 50-bead baluns without the heat-shrink tubing.

"By adjusting your quad's polarization to maximize signal strength at the start of each T-hunt, you can avoid the problems of hunting cross-polarized signals."

not fun if you have to stop and get out in the rain. Sometimes there are several transmitters to be found with different apparent polarizations, requiring frequent changes. Wouldn't it be better to be able to make the selection quickly from inside your vehicle?

Crossed yagis have been successfully used by T-hunters for polarization agility. Back in April 1989, "Homing In" described the setup of Vince Stagnaro WA6DLQ, who put the elements of two KLM yagis on one boom

elegant solution would take advantage of the cubical quad's inherent symmetry, which makes all elements able to support both polarization modes simultaneously.

Let's go back to basics for a moment. AC currents at VHF frequencies in antennas behave differently from AC currents at 60 Hz in your house wiring. The quantity of electrons passing per second along the power cord of your toaster is the same at the plug end, the toaster end, and everywhere in between. But if you could measure the RF current at several points along the driven element (DE) of a quad antenna, you would find that it differs. This property makes the DE radiate transmitted signals and pick up received signals.

Fig. 1(a) shows a typical quad driven element loop. Circumference is one wavelength, about 80 inches at 2 meters. The feedline is connected to point A, which gives a horizontally-polarized transmitted signal. Received signals of horizontal polarization induce currents in the loop that go down the feedline to the receiver.

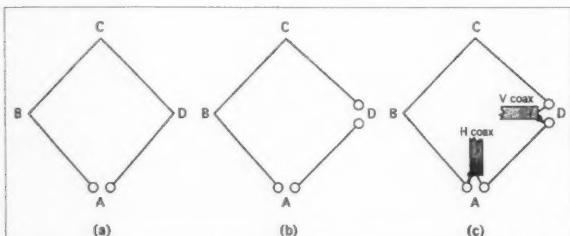


Fig. 1. At (a), the driven element of a horizontally-polarized quad. The feedline connects to point A. Breaking the loop at point D as in (b) does not affect horizontally-polarized operation. Attaching feedlines at A and D as in (c) allows extraction of both horizontally and vertically-polarized signals, if the outsides of the coaxes are decoupled.

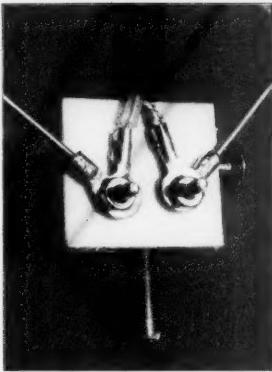


Photo B. Close-up of a feed point block. The first bead fits over the point where coax shield and center conductor are separated.

coax shield) at a current null point in your favorite quad DE and watch the pattern change for the worse.

Fortunately, current flow on the outside of the coax can be choked off to restore the current minimum. A balanced-to-unbalanced transformer (balun) will do it. RF current will be confined to the coax inner conductor and the inside of the shield, and will remain near zero for cross-polarized signals. For the unused polarization mode, it is almost as if the coax isn't there at all!

VK5RN has documented a circularly-polarized quad for OSCAR satellite work that has two feedlines with sleeve baluns³. These devices, sometimes called bazookas, are made from thin-wall metal tubing of carefully selected diameters. I did not want to use a pair of bazookas on my T-hunt mobile quad because they are heavy and would add lots of asymmetrical windload at freeway speeds. Instead, I tried a choke of ferrite beads. Measurements by W2DU⁴ show that 25 beads of #43 ferrite material over a coax line provide 850 ohms impedance to currents on the outside of the shield at 2 meters.

Does it work?

I built a modified Cubex Yellowjacket⁵ four-element 2 meter quad by installing two feedline termination blocks instead of one. Part number FB-

43-2401 beads⁶ have an inner diameter of 3/16", so they fit nicely over the RG-58/U feedlines once the outer jacket is removed. The two feedlines go down the 3/4" Schedule 40 PVC pipe mast to a two-position coax switch in the van, then to the receiver. Coaxes are exactly the same lengths to make it easier to achieve circular polarization, as will be shown later.

At a local hilltop, I compared the new dual-polarization quad to an unmodified Cubex Yellowjacket using a calibrated attenuator plus local and distant repeater signals. The results delighted me. The directional pattern of the dual-quad was just as good as that of the reference quad. Cross-polarized signals were attenuated 14 dB by the dual-quad, which represents about 3/4 scale on my receiver's S-meter.

Forward gain of the dual-quad was about a half dB less than the reference, a negligible difference. Making the comparison was difficult because when testing the stock quad, the S-meter would vary plus or minus 20% as the feedline was moved around inside the van, due to feedline signal pickup. On the other hand, output of the dual-quad was rock solid with feedline movement, thanks to decoupling by the ferrite baluns.

About this time, a Saturday night mobile T-hunt was getting underway. I decided to give the quad a real workout. KD6LOR and KK6ME had put out three hidden T's, transmitting intermittently on 146.565 MHz. Only one was copyable when I left the hilltop. By switching between feedlines, it was easy to tell that this signal had horizontal polarization. After I had gone a few miles, I began to detect weak signals after each transmission from the strong T. I toggled the coax switch a few times and determined that the weak signals were stronger in the vertical mode.

I found the strong signal first. It was in KD6LOR's truck in a parking lot overlooking Mission Viejo. Sure enough, its transmitting antenna was a horizontally-polarized quad. I then took on the

other two T's, which clearly had vertical polarization. There was now a bit of overlap in the transmissions and it was nice to be able to switch polarization to minimize the signal from the horizontal T while hunting the others.

Before long, I had found both of the weaker T's. Each had a quarter-wavelength vertical whip antenna mounted on a surplus ammunition can. One was chained to the base of a high voltage power line transmission tower, while the other was in a park on a steep hillside overlooking Lake Forest. This hunt was enough to convince me that a polarization-agile quad would be my new "weapon of choice" for many future hunts.

Although gain and pattern of the test quad proved to be excellent, SWR was over 2.5:1. Upon further testing, I found that the DE was resonant at about 141.5 MHz. Apparently the pigtail between the ends of the bead baluns and the feedline blocks add to the DE's resonant length. I shortened the DE wires, which improved SWR but caused the pattern's back lobe to worsen. After some experimentation, I found that moving the reflector four inches closer to the DE made the SWR even better and minimized the back lobe.

SWR is now 1.6:1 for both polarizations. This is fine for

receiving, because the feedline is decoupled well. Your receiver probably does not have exactly 50 ohms input impedance anyway. I also tried 50 beads per balun instead of 25 (**Photo A**). This increased cross-polarized signal rejection from 14 to 17 dB.

You can make one

Your favorite 2 meter corner-fed no-gamma diamond quad design should be suitable for use with this dual-polarization feed technique. Baluns of 25 beads each are adequate for RDF and inexpensive.⁷ You will need to strip the jacket from RG-58/U coax for the beads to fit. Do not strip or comb the shield braid under the beads. If your coax diameter is so small that the beads will go over the jacket, it is not standard RG-58/U and not recommended for VHF.

Cover each balun with heat-shrink tubing and add a dollop of hot glue or other sealant at the ends before shrinking to keep water out. Keep the shield and center conductor leads from balun to feed block short. Remember that they add to the DE resonant length. These pigtailed are just 3/4" each on my quad (**Photo B**), compared to 1-1/2" in the Cubex instructions.

As a check of your dual-feed quad's construction, try

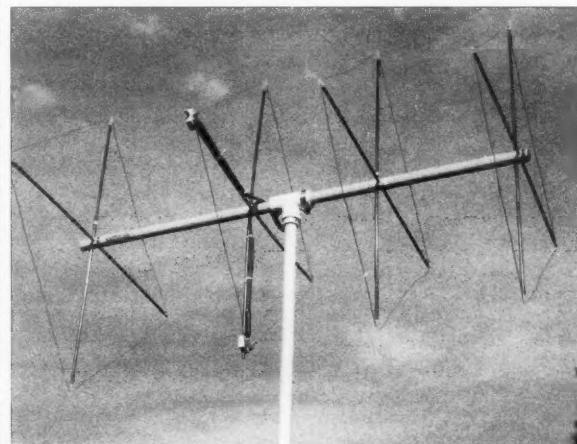


Photo C. The dual-quad is mounted and ready for a hunt. Note that the feedline passes over the top of the boom, but does not wrap around as it does in stock Yellowjacket quads.

ABOVE & BEYOND

VHF and Above Operation

transmitting on 2 meters into one feedline while terminating the other with a wattmeter and a good VHF dummy load. Very little RF should leak from coax to coax. In my case, transmitting 22 watts into the horizontal coax gave only 6 milliwatts out of the vertical coax, and vice versa (35 dB isolation).

Wire lengths of the DE on my modified Yellowjacket are 18-3/4" for the wire between the two feed blocks (measured screw-to-screw), and 59-3/8" for the wire that forms the other three sides of the loop. Lengths of the other Cubex element wires are unchanged. Cubex instructions call for six turns of feedline around the Yellowjacket boom, but these added turns are unnecessary and undesirable when the ferrite baluns are in place (**Photo C**). Cubex suggests using RG8X low-loss feedline, but the difference in loss for short mobile T-hunting feedlines is negligible.

Hiders occasionally transmit unusual polarizations. For instance, an ammunition-can T propped up in a tree may put out a signal polarized at a 45-degree angle between horizontal and vertical. There have even been some circularly polarized T's to find on our Saturday night hunts.

By combining signals from the horizontal and vertical feedlines of the dual-quad with proper phase relationship, you can achieve 45-degree and circular polarizations. "Homing In" for April 1989 has plans for WA6DLQ's six-position polarization switchbox. Though intended for use with his dual-feed yagi, it will also work with the dual-quad. A similar switchbox is in the Radio Society of Great Britain's

VHF/UHF Manual. Feedlines from switchbox to each feed point must be exactly equal lengths when using the switchbox.

If T-hunting in your area requires you to make frequent polarization decisions, consider adding a dual-polarization quad to your bag of tricks. Ed Buchanan of Cubex has agreed to sell a dual-feed version of the Yellowjacket quad to "Homing In" readers. It includes two feed point termination blocks and associated hardware. Contact Cubex directly and ask for the T-hunt Special. Please understand that I have no business association with Cubex, so do not send inquiries about this offer to me.

Whether you make your own dual-polarization RDF quad or try the modified Cubex Yellowjacket, let me know how it works for you. Send E-mail to Homingin@aol.com, or write to me at the address at the beginning of this article. Don't forget to check out the Homing In Web site: <http://members.aol.com/homingin/> is the URL.

References:

1. Dopplers and time-difference-of-arrival RDF sets use vertically polarized dipoles or ground plane antennas.
2. Available from Roy Lewallen W7EL, P.O. Box 6658, Beaverton, OR 97007.
3. Robertson, "The Quadraquad—Circular Polarization the Easy Way," *QST*, April 1984, page 16.
4. Maxwell, "Some Aspects of the Balun Problem," *QST*, March 1983, page 38. Ferrite baluns are also briefly described in recent editions of *The ARRL Handbook*.
5. Cubex Quad Company, 2761 Saturn Street, Unit C, Brea, CA 92821; (714) 577-9009.
6. Available from Amidon Associates, P.O. Box 956, Torrance, CA 90508; (310) 763-5770.
7. Prices for FB-43-2401 beads from Amidon are \$4.50 per dozen or \$16 per hundred, plus shipping/handling.

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equipment is tuned for commercial or military frequencies, making it unusable on amateur frequencies without modification. This is what causes the same piece of equipment to be so much junk for one person, but a treasure for someone equipped for retuning.

High technology: good news and bad news

Microwave circuit fabrication techniques have progressed from waveguide to microstrip printed circuit boards to ceramic substrate hybrids to large-scale monolithic integrated circuits. Waveguide-type equipment still finds favor among those beginning on the amateur bands at 5.7 GHz and above, but microstrip circuits are prevalent among those building medium- to high-performance amateur equipment through 24 GHz. The good news is that the microstrip surplus is typically available because the industry is moving into higher and higher integration technologies such as the hybrid or MMIC.

The bad news is that the newer technology equipment often contains integrated components which are internally matched or tuned for a specific frequency and are not practical for most amateurs to modify. An example of a nonmodifiable piece of surplus is the typical VSAT terminal now becoming available. These units contain >1 watt transmitters at 14 GHz and low-noise receivers around 12 GHz, but are so highly integrated that very few of the microwave components are usable for amateur purposes.

The conversion of microwave surplus equipment may eventually dwindle as the modifiable technologies disappear, but this should not be a problem for some years to come. Another good side of the newer technologies is that they provide high performance with low cost and ease of application for those assembling their own microwave circuit boards.

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using new components. Below are some examples of successfully modified surplus equipment.

C-band TVRO LNAs

These low-noise amplifiers are available in the \$5 range at local flea markets. In their original condition, they provide about 50 dB gain with a 1 dB noise figure over the 3.7 to 4.2 GHz range. They require about +15 to +24 to operate with power being supplied to the output connector. When the internal filters are removed the amplifier is usable over the .8 to 4.2 GHz range, with the noise figure increasing to about 3 dB at the

may change the output by less than 1 dB. The signal level needs to be large enough at the beginning to have measurable output appear, but should be reduced to keep any stages from possibly saturating. For small signal devices the input should not exceed about +5 dBm to prevent device damage.

Attenuators

Attenuators (3 dB minimum) should be applied directly to the input and output of the circuit to be tuned, for two reasons: To reduce any possible test setup mismatch that might otherwise be

"An astute amateur can buy a piece of microwave surplus for much less than the cost of a few new key components."

low end. I have used one of these units as the 2.4 GHz LNA for an OSCAR-13 receiver.

Ku-band power amplifiers

Several types of 14-14.5 GHz power amplifiers with 25 dB or more gain and .5 to 2 watts output are available for about \$35. These units are readily retunable for use on the 10 GHz amateur band, with somewhat increased output over that available at 14 GHz.

Ku-band LNA

Several types of Ku-band TVRO and VSAT LNAs are available in the \$20 range. These can typically be retuned for use on the 10 GHz amateur band, providing 20 dB gain and a 1 to 3 dB noise figure.

Tools and test equipment: signal sources

Almost any available source that can be set to the frequency range of interest can be used. Usable sources include commercial signal generators as well as Gunn, transistor, FET, and YIG oscillators. The frequency stability of most sources is more than adequate for tuning microstrip circuits. Short-term amplitude stability is needed; often a single matching element adjustment

compensated for in the tuning process, and to protect the power measuring equipment and the equipment being tuned. This is a particularly important point when working with power amplifiers which may accidentally oscillate during the tuning procedure.

Power monitors

Almost any type of power monitor can be used as long as it has sufficient resolution and stability to identify changes of .5 dB or less. I started with a spectrum analyzer but found a power meter to be much more satisfactory for detailing small changes.

Power supplies

Power supplies should be well regulated and have current limiting which is adjustable to just above the nominal operating current. The bipolar devices typically use a single power supply while the GaAs devices typically require a negative gate bias. The gate bias should normally be applied prior to applying the drain voltage to prevent possible device damage caused by the transistor attempting to turn on hard.

My experience has been that the properly adjusted current-limited supply will prevent device damage should the gate bias be accidentally removed during the

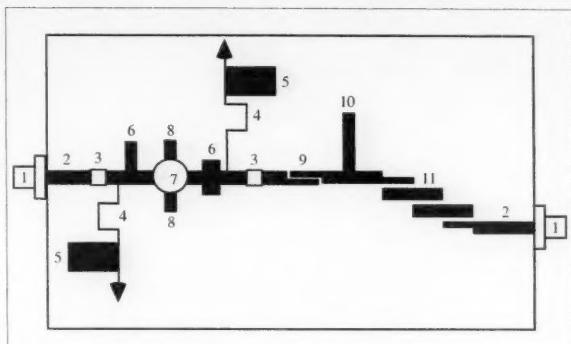


Fig. 1. Typical microstrip circuit components, showing layout of microwave amplifier filters and associated stripline components:

1. RF input/output connectors
2. Main 50Ω microstrip transmission line
3. DC blocking/interstage coupling capacitors
4. High impedance bias lines >100Ω, usually 1/4 wavelength (as long as these are narrow lines, no modification needed)
5. 1/4 wave pads to provide RF ground to bias lines (open one end), normally no modification needed
6. Matching stubs may be symmetrical or asymmetrical (may need to be removed for best results)
7. Bipolar or FET device: FET gate values typically -5 to -1.5V; FET drain values typically +2 to +9V
8. Emitter or source ground pads (direct connection to ground plane is critical)
9. Interstage filter/DC block; typically, cut with craft knife and insert capacitor (difficult to retune)
10. 1/4 wave bandpass filter (one end grounded), typically disconnected at main transmission line; possibly retunable if length/ground point can be modified
11. Bandpass filter, modifiable with some success by symmetrically extending all elements of filter.

tuning process. Always remove power when making connections and soldering tuning stubs. Make sure the amplifier output is terminated before applying power. The power supply ground output should be connected to earth ground.

Soldering iron

A soldering iron with a very small grounded tip is essential. The grounded tip is absolutely necessary to prevent 60 Hz power line or static potential from damaging GaAsFET devices. Small signal GaAsFETs are often damaged if the gate voltage exceeds 3 to 5 volts. The drain voltage limit is typically 5 to 8 volts. The limit for power devices is usually a few volts higher.

Microstrip tuning techniques

Here is the basic approach I

have used to retune many surplus amplifiers:

Everything must be grounded to power (earth) ground including the soldering iron tip. The typical FETs in microwave amplifiers will self-destruct with more than 5-10 volts on the gate.

Apply only as much input RF power as required to get usable output measurement. This reduces the chance of damage to higher power devices prior to getting the output matched. Also, it prevents saturation of a stage which then appears not to respond to tuning. Applying more than about +10 dBm directly to small FETs may cause damage.

Use current-limited power supplies set to limit slightly above the normal expected operating current. This will in most cases prevent blowing up the FETs if the negative gate bias is missing or something is accidentally shorted with the tuning wand. With this approach, sequenced turn on of

the power supplies is not usually important.

Place attenuators directly at the input and output of the amplifier. This removes the effect of poor cable, source and power detector matching. Always remove power when making connections and soldering tuning stubs. Make sure the amplifier output is terminated before applying power.

ohm line. Be careful not to cut the thin brass lines. If you are unsure of possible damage to the bias lines, carefully check continuity or use a magnifier to do visual inspection before applying power. In some cases it pays to go through the agony of removing the stub completely as the correct new stub placement may overlap and cause problems.

verify that the output is as high or higher than obtained with the wand. Move the tuning stub if required to obtain results equal to or better than those of the wand.

Slide the wand over the previously attached new stub and if improvement can be made, attach another square. Continue this for the entire length of the main 50 ohm line until no further improvement is found. Increase the input power if working with a power amplifier and retune the output stage for maximum power. Be careful here not to mismatch the output so badly with the wand as to damage the FET.

The process can be very slow, with some stubs only gaining a fraction of a dB. In most cases it will take all of those small increases to get good results so don't expect to see major improvement with a few stubs. It may take four stubs per stage sometimes to get the maximum output.

Additional notes

Direct grounding of a microwave power device emitter/source is essential for proper operation. Any form of insulating grease can prevent full gain/power output from being obtained.

When mounting boards into enclosures, take care to ensure that the entire perimeter of the board is connected to the enclosure to prevent oscillation. **73**

LETTERS

Continued from page 7

truly are the unsung heroes of amateur radio—I thank you all, and please do keep up the great work! There are people out there who really do appreciate it.

Aw, shucks... Wayne.

Roger Wendell WBØJNR. Wayne, in "Never Say Die" you asked if we'd like to hear you talk about something besides ham radio. You bet! How about the beauty of 3.5 billion years of organic evolution and what hams can do to save it? We don't need any more money schemes, dirty religions, or mindless hobbies—we need more of nature—the real world.

Roger, I've flown over the Pacific Northwest, so I've seen the ugliness of clearcutting our forests. I've seen the horrendous scars of strip mining. I'm also seeing the pollution of the radio frequencies, with around 30,000 rock music radio stations crowding my AM and FM dial, and 200 or so TV channels of mind-rotting crud. Our school system is crumbling. Our health care system is just as bad as our school system. Crime, drugs, welfare, and so on. Yes, we've made a real mess of our states, country and planet and we're trying to figure out how to go out and spread it to other planets. So what do we do, knuckle under and try to cut as big a piece of the pie as we can for ourselves, and to hell with the mess we make doing it? Or do we fight? But how can you fight City Hall? I've already proposed a way we can secretly infiltrate the "system" and start changing it, working from the inside. Roger, we hams are 700,000 strong, but only if we're working together. As individuals we're of no significance. Yes, as small a group as we are—we have the potential to change our cities, our states, our country, and then the world. Our foes are entrenched interests, apathy, and indifference. Our strength is a never-say-die attitude. Motivation. Determination. Perseverance. Roger, 700,000 people can be an army... Wayne.

Cliff Gieseke W4ZFL. UFOs are a topic I've been fascinated with since the early '50s, when I was first

Continued on page 62

"Several types of 14-14.5 GHz power amplifiers are readily retunable for use on the 10 GHz amateur band."

Tuning procedure

Prepare the tuning wand and tuning stub material. Cut about 1" or 2" strips .080" wide (not critical) of about the same width as the main 50 ohm microstrip lines in the amplifier from thin copper or brass stock (.003" to .010"). Tin both sides of the strips and flick off excess solder. Make several tuning wands by cutting one end of a wooden toothpick square at the largest diameter. Using SuperGlue™, attach a square (.080" x .080") of the prepared tinned copper or brass to the curved end of the toothpick. Wipe off excess glue from the exposed side of the square and let dry.

Remove existing tuning stubs. Using an X-Acto™ knife, make a deep enough cut to disconnect tuning stubs from the main 50

ohm line. Be careful not to cut the thin brass lines. If you are unsure of possible damage to the bias lines, carefully check continuity or use a magnifier to do visual inspection before applying power. In some cases it pays to go through the agony of removing the stub completely as the correct new stub placement may overlap and cause problems.

Do not add solder. The tinning is normally sufficient to allow the new tuning stub to be held in place with the pointed end of a toothpick and then just touched with the soldering iron to reflow the solder. Turn on the power and

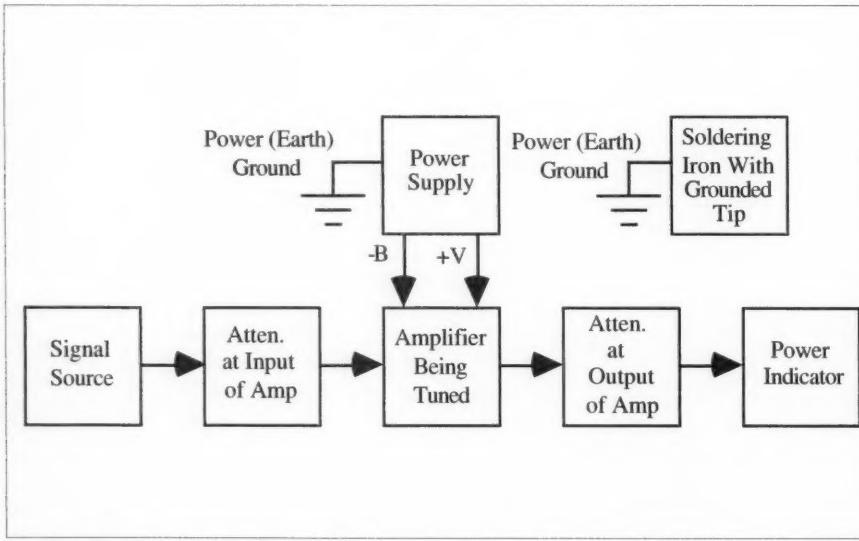


Fig. 2. Equipment configuration for retuning microstrip amplifiers.

Low Power Operation

Michael Bryce WB8VGE
P.O. Box 508
Massillon OH 44648

This month, I have some more odds and ends for you. These circuits and tidbits may help you enhance the performance of your QRP equipment.

A&A Engineering RIT modifications

The first project comes from John Best, Sr. WA1YIH. John took the RIT circuit for the MFJ QRP monobanders and modified it to work with the Gary Breed K9AY/A&A Engineering 30 meter rig. The original circuit appeared in 73's "QRP" column for November '95. Here is John's modification:

"I modified the RIT circuit for the MFJ rigs to work with my A&A Engineering QRP transceiver. I used a Radio Shack IC board, 276-159, and ugly construction.

"To modify the rig, you have to remove the fine-tuning control. The fine-tuning control connects to the main tuning circuits. The wire that goes from the main tuning to the fine-tuning is removed and hooked to R2 (the 470 ohm resistor). The wiper of the fine-tuning is grounded. One side of the fine-tuning is connected to pin 2 of the 4066. The rest of the circuit is self-explanatory."

John reports that he gets approximately 800 Hz offset on either side of the RIT control center position. John's RIT indicator is pretty simple. He used a dual-colored LED, Radio Shack™ #276-025, and a DPDT switch.

John says, "I use the green as a rig power indicator as well as RIT off, and the red for RIT on."

With the fine-tune control out of the circuit, I would suggest you replace the original single-turn tuning control with a multi-turn pot. I've seen these units listed as surplus for under 10 bucks. Also, if you favor one segment of the band over another, I would change the voltage divider used to drive the VXO. Expanding the range within a segment will give

you super-smooth tuning. On the downside, it would be real slow to go from one end of the desired segment to the other.

Wimpy 386 audio

If you've ever built a QRP rig, it's a good bet you've used the LM386 audio amplifier. It's almost a standard part—every QRP builder should have one in his or her junk box.

However pleased you may be with your home-brewed or commercial rig using an LM386 for the audio output stage, you can be in for a shock if you compare it to another rig. Side by side, with the same LM386 audio driver, some QRP rigs are much louder. I noticed this several years ago at the annual Dayton Hamvention QRP forum.

We were playing with a new commercial rig. The audio was very wimpy. In fact, with a room

full of people fixing the world's problems, you could hardly hear anything from the speaker. The guy who had just purchased the rig mentioned that the reason was the LM386. "There's not much audio inside an LM386." At that time someone looking over our shoulders said his rig had more than enough audio, so much in fact you could easily hear it in this room full of people.

So, we connected his rig up to the same antenna. We tuned in a station on 40 meters. With the volume control up only to halfway, someone across the room yelled at us to "Turn that damn thing down so we can talk." Indeed, the LM386 in his rig was really spitting out the audio!

Now, there are only so many ways you can configure a LM386 audio amplifier. You can select the amount of gain produced by swapping out a capacitor, but you can't generate more gain than the device will produce. Since we were using the same antenna, that ruled out any gain produced by the RF section. Both rigs were

based on a direct conversion receiver, so almost all of the gain of the rig had to be in the audio chain. Everyone seemed to narrow the difference down to audio preamplifiers before the LM386. That was several years ago. Here's some info I have since dug up about this unique chip.

First, if you have a choice, get the LM386 made by National Semiconductor. Although the LM386 is made by a wad of companies, the National devices seem to work better.

Everyone I've talked with has been under the that assumption the LM386 is a 1 watt audio amplifier, but it actually comes in a variety of different power levels. Fact is, some are rated for only 300 mW! You can tell by the number on the chip. An LM386-1 is rated for 250 mW, the LM386-3 is rated for 500 mW, while the LM386-4 is rated at 700 mW. National spec sheets say normal power output for this version is close to 1,000 mW.

There are two other problems with LM386 designs. One is

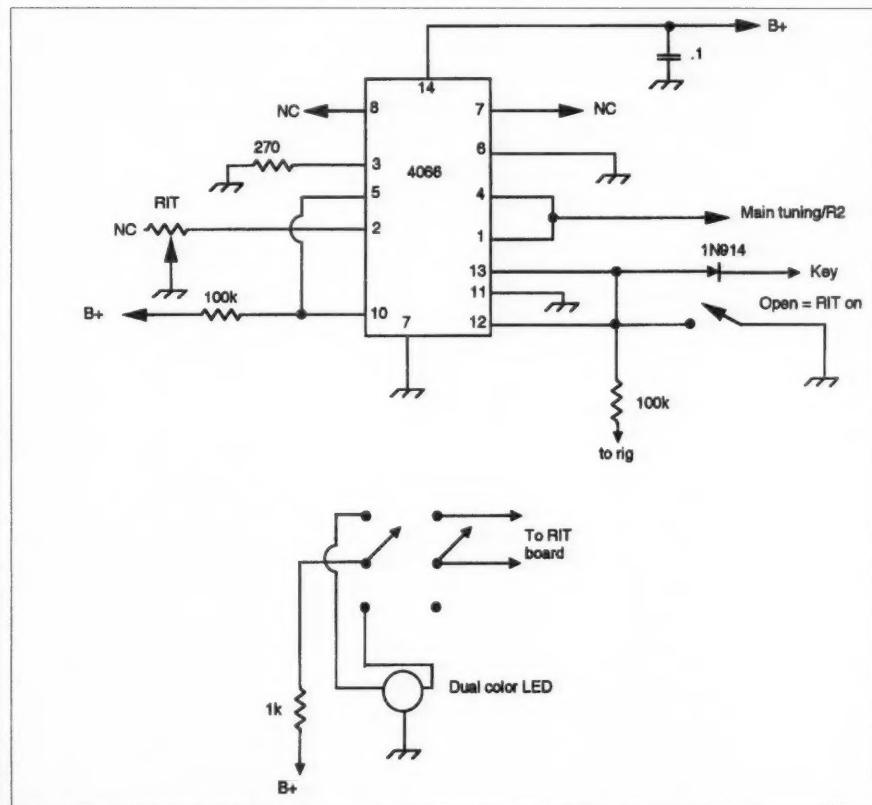


Fig. 1. WA1YIH's modified RIT circuit.

SPECIAL EVENTS

over-driving the amplifier. This is a very common problem, especially with home-brewed equipment. Let the gain of the amplifier do its job—you don't need to apply 200 mW of drive! Design your audio preamplifier so it provides the proper level for the LM386.

Another problem with some LM386 designs is a tendency to oscillate, or "motorboat." With rare exceptions, this can be cured by increasing the value of the decoupling capacitor on the VCC line of the LM386. It's also good practice to have this capacitor mounted as close as possible to the chip. Many designs show the value of this decoupling capacitor at about 220 μ F. Increasing the value to 470 or 1,000 μ F will usually do the job.

In really stubborn cases, a small value resistor, usually 10 or 22 ohms, may be inserted in series with the VCC line feeding the LM386. A 1/2 watt resistor should be used instead of the junk box 1/4 watt device.

An all-too-often overlooked item when fixing a wimpy LM386 is a poorly regulated power source. If your rig is running from a battery, and there is an internal 7812 regulator feeding the LM386, the regulator won't have enough overhead to regulate. This will cause the voltage supplying the LM386 to wander about. You can prevent this several ways.

First, you can run the LM386 from the input side of the regulator, assuming the input (supply) voltage is between 12 and 14 volts DC.

If this is not possible, you can use a voltage regulator with a

lower voltage rating. A 7810 will have the necessary overhead when using a 12 volt supply, but just barely! A 7808 would be ideal, provided your circuit will operate at 8 volts. There is a 7809, but it's hard to come by.

If you need to increase the voltage of a 7808 regulator, there are two fixes. First, you can put a diode in series with the ground pin. For each diode, you will raise the output by .7 volts. Or, you can use a resistor connected to the ground pin. In both cases, you raise the ground pin slightly above ground, which causes the output voltage to increase. I should mention that neither way is the preferred method to increase the voltage of a three-terminal regulator. It's always best to specify the correct voltage regulator for the circuit under design.

Last month's schematics

Some of the schematics were missing from last month's column. Moving into a micro apartment has really put the screws to me. As things begin to settle down, I'll be able to get back into my routine. If you are interested in some of the missing schematics, drop me a line. Do be sure to send letters to my new address, P. O. Box 508, Massillon, Ohio 44648.

Out of all this madness, a 100 percent solar home will be constructed. A 4 kW peak solar array is planned. Also planned is a 65-foot free-standing tower, complete with some real antennas! The best part of it all is that by the time I'm done, the sunspot cycle should be taking off. Talk about good timing!

Listings are free of charge as space permits. Please send us your Special Event two months in advance of the issue you want it to appear in. For example, if you want it to appear in the June issue, we should receive it by March 31. Provide a clear, concise summary of the essential details about your Special Event.

FEB 8

CHARLESTON, SC The 24th annual Charleston Hamfest and Computer Show will be held at Stall H.S. near I-26 and Ashley Phosphate Rd., in North Charleston. Tailgating allowed. Talk-in on the WA4USN Linked Rptr. Sys. 146.79(-) Rptr. aboard the *USS Yorktown* and the 145.25(-) Rptr. near Summerville. Tickets will be sold Sat. morning at the door; \$5 for adults. Children under 12 admitted free. Pre-reg. tables are \$8 per 8 ft, \$10 at the door as long as they last. Make check payable to C.A.R.S. Hamfest Committee, and send with an SASE, to Jenny Myers WA4NGV. Table reservations must be received before Jan. 24th. VE Exams on site starting at 12 Noon. Walk-ins. Bring original and copy of your license, any CSCEs you have, and two IDs, one with a photo. For exam info, call Ed Frank KC4OOZ, 610 Longstreet Cir., Summerville SC 29483. Tel.(803) 871-4368; or Doc W4MUR, (803) 884-5614 or E-mail: efrank@charleston.net. The Hamfest contact is Jenny Myers WA4NGV, 2630 Dellwood Ave., Charleston SC 29405-6814. Tel. (803) 747-2324, or E-mail: brycemyers@aol.com. VE Exams are also given monthly on each 3rd Saturday, at Trident Tech College, Rivers Ave., North Charleston, Bldg. 630 at 9 AM. Contact Ed Frank KC4OOZ, (803) 871-4368.

DEARBORN, MI The Michigan Antique Radio Club will host its Swap Meet at the Armenian Hall on Ford Rd. Open to the public 8 AM-Noon. Adm. \$2 per person. A Silent Auction, Equip. Contest, and a Donation Auction will be featured. Contact Jim Clark at (517) 349-7187.

FEB 9

MANSFIELD, OH The Mansfield Mid-Winter Hamfest/Computer show will be held by the InterCity ARC, Inc., at the Richland County Fairgrounds in Mansfield. Doors open at 7 AM. Tickets \$4 in advance, \$5 at the door. Tables \$9 in advance, \$12 at the door, if available. Advance orders must be received and paid by Jan. 13th. Send requests, payments, and SASE to Pat Ackerman N8YOB, 63 N. Illinois Ave., Mansfield OH 44905; or phone (419) 589-7133 after 1 PM EST. Talk-in on 146.34/.94 W8WE.

FEB 13 and 27

FORT WORTH, TX The Lockheed ARC and the Kilocycle Club of Ft. Worth will sponsor VE Exams for all classes at the Lockheed Rec. Area Facility located at 2400 Bryant Irvin Rd. Exams start at 7 PM. G.R.D.L. testing done by appointment only. Call Ted Richard AB5QU at (817) 293-6745.

FEB 14-16

ORLANDO, FL The OARC of Orlando will host the Orlando HamCation and Computer Show, and ARRL North Florida Convention at Central Florida Fairgrounds. Set up Fri. 9 AM-5 PM; open to the public Fri. 5 PM-9 PM, swap tables only. Sat. 9 AM-5 PM and Sun. 9 AM-4 PM. 150 commercial exhibits. Largest tailgate area in FL. RV overnight parking \$16. Adm. \$6 advance, \$9 gate. Free parking. Swap tables \$25/Tailgate \$15 all 3 days. For advance tickets and info, contact Orlando HamCation, P.O.

LETTERS

Continued from page 60

licensed as WN4ZFL and W4ZFL in Pensacola, FL, as a teenager. I teach foreign military personnel at the Defense Language Institute English Language Center at Lackland AF Base and last week I was introduced to a Turkish AF officer there who had an encounter with a UFO. About five years ago, he told me, he was in the front seat of an F-104 when his instructor in the back seat called his attention to

an approaching disc-shaped bright light. It continued to approach them, and when it was quite close his instructor decided to initiate the ejection sequence. Before he was ejected, after being told to prepare for ejection in 10 seconds, he saw the UFO veer away from them, but too late to save the aircraft. The approach of the UFO to their aircraft was, fortunately for the pilots involved, witnessed by personnel in a control tower close to the runway.

Other DLIELC students have told me of UFO encounters over the years. While teaching all the military officers attached directly to the Colombian president (his personal pilot, security chief, protocol officer, a Navy liaison officer, and the colonel in charge of "La Casa Militar") a number of years ago at the Presidential Palace in Bogota, Colombia, I asked these officers one day when we were all together

if they thought the most likely explanation for the more reliable, more substantial, credible reports was that we are being visited by extraterrestrials. Going around the conference table with this question I was fascinated when each officer responded with a "Yes." That's the only military group I've taught over the past 30 years that was so unanimous when asked such a question.

Continued on page 81

Box 547811, Orlando FL 32854.
E-mail: kd4jqr@aol.com. **Web Page**
www.cycat.com/users/oarc. **Forums:**
 NASA Astronaut, Slide/Photo Exhibit
 of Lightning Storms, ARRL, APRS
 Demo by Bob Bruninga, WX
 Downloads, WX Equip. for the
 Home, Shortwave Listening by Bob
 Grove, pub. *Monitoring Times*; Build
 a VHF SWR Meter; Grounding for
 Lightning; Antenna Workshop;
 Radio Testing, and more.

FEB 15

HARRISBURG, PA The Harrisburg ARC will hold its Winter Hamfest 8 AM-Noon at the Oberlin Fire Hall, Oberlin PA. General adm. \$2. Inside Tables \$8 ea. Tailgating \$1 per space. Dealer Set up at 6 AM. VE Exams start at 9 AM. Talk-in on 146.76. For info and table reservations, phone the *HRAC AnswerLine* at (717) 232-6087.

HORSEHEADS, NY The ARA of the Southern Tier will present a Hamfest at the New York State Armory, 128 Colonial Dr., 7 AM-3 PM. There will be dealer displays of new equipment and an indoor Flea Market area. Tables will be available on a first-come basis. VE Exams start at 9 AM. Contact **Jack Slocum**, 410 Shelbourne St., Horseheads NY 14845. Tel. (607) 739-4866.

TRAVERSE CITY, MI Cheryland ARC will hold their 24th annual Swap-n-Shop at Immaculate Conception Middle School, 8 AM-Noon. VE Exams following the Swap at 1 and 4 PM. Talk-in on 146.86. For more details call Joe W8TVT at (616) 947-8555, or Chuck W8SGR at (616) 946-5312.

FEB 16

BRIGHTON, CO The Aurora Rptr. Assn. will hold its 15th annual Swapfest at the Adams County Fairgrounds, 9755 Henderson Rd., 8:30 AM-2 PM. For details, contact **Chris Knauer KB9CCR**, (303) 403-1883; or E-mail at cknauer@skywarn.org; or write to **Aurora Repeater Assn.**, c/o Janice Christopherson, 4376 S. Argonne Way, Aurora CO 80015.

NEW WESTMINSTER, BC, CANADA The Burnaby ARC, VE7RBV, will hold the "Burnaby ARC 10th Annual Fleamarket" at New Westminster Armouries, 6th St. and Queens Ave., 10 AM-2 PM. Set up at 9 AM. Talk-in on VE7RBV 145.35(-) or 442.85. For info and tables, phone between 7 PM-9 PM PT: **Harry VE7HNC**, (604) 530-3962; **Graham VE7ABC**, (604) 530-1907; packet

VE7ABC@VE7KIT; or **Rick VE7HRL**, (604) 464-0768.

FEB 22

LAPORTE, IN The LaPorte ARC "Cabin Fever Hamfest" will be held 8 AM-2 PM at LaPorte Civic Center. Adm. \$4; tables \$5 ea. Talk-in on K9JSI 146.610 (131.8PL), 443.900 (131.8PL) and 146.520 simplex. For details contact **John N9ROH**, LPARC, P.O. Box 30, LaPorte IN 46352.

MILTON, VT The Radio Amateurs of Northern Vermont will sponsor the Northern Vermont Winter Hamfest 8 AM-3 PM at Milton H.S., Route 7. Features include Flea Market, Auction, Dealers, Book Sales, Forums, and more. VE Exams will be given at 9 AM and 2 PM. Commercial Exams at 2 PM. Adm. \$3, free for under 18 years. Tables are free while they last. Call for large setups. Talk-in on 145.15 Rptr. Contact **W1SJ** at (802) 879-6589. E-Mail: wb2jsj@vbi.champlain.edu. Web Site: <http://www.together.net/~flynn/milton.html>.

FEB 23

CUYAHOGA FALLS, OH The Cuyahoga Falls ARC will host its 43rd annual Hamfest at Emidio's Party Center, 48 Bath Rd., 8 AM-2 PM. Free parking. Talk-in on 147.87/.27 W8VPV. Adm. \$4 advance, \$5 at the door. Reserve tables by Feb. 8th, \$8 advance, \$10 at the door, if available. Contact **Bob Recny N8SQ**, 496 Orlando Ave., Akron OH 44320-1243. Tel. (330) 864-5810; FAX (330) 864-5879; E-mail: hamfest@neo.lrun.com.

MAR 1

ABSECON, NJ The Shore Points ARC will sponsor its 15th annual hamfest, "Springfest '97" at Holy Spirit H.S. on Route 9, starting at 8 AM. Set up at 6:30 AM. Flea Market, outdoor Tailgating (weather permitting). Talk-in on 146.385/.985 PL 146.2 Hz. For info, write to **SPARC**, P.O. Box 142, Absecon NJ 08201; or call/FAX (609) 653-1987.

PARSIPPANY, NJ The annual North Jersey Hamfest, sponsored by Split

Rock/West Morris Radio Clubs will be held at the PAL Bldg. on Smith Rd. Talk-in on 146.985/.385. For info or reservations, call **Bernie WB2YOK**, Fax/Voice (201) 584-5399 24 hrs.; Online 75503, 3221@compuserve.com.

MAR 15

KNOXVILLE, TN The Shriners of the Kerela AR Service will sponsor the Kerela Hamfest at the Kerela Shrine Temple, 8 AM-4 PM. Adm. \$5. Indoor vendor tables \$8 ea., plus adm.; outdoor tailgating spaces are \$3 plus adm. Set up at 4 PM-9 PM Fri, and 5 AM-8 AM Sat. Talk-in on 144.83/145.43, or 146.52 simplex. Smoking in designated area only. Contact **Paul Baird K3PB**, 1500 Coulter Shoals Circle, Lenoir City TN 37772. Tel. (423) 986-9562.

SPECIAL EVENT STATIONS

FEB 8-10

ST. PETERSBURG, FL The QCWA Golden Anniversary QSO Party will be open to all Amateur Operators, world wide, 1400 UTC Feb. 8th-0600 UTC Feb. 10th; and 1400 UTC Mar. 8th-

0600 UTC Mar. 10th. For rules, send request and a business size SASE to **J. Frederick Strom K9BSI**, Activities Mgr., 233 34th Ave. North, St. Petersburg FL 33704-2241. All logs must be received no later than Apr. 1st, 1997. Mail Feb. logs to **Arthur Monses W4BK**, 420 Bay Ave., Apt. 1521, Clearwater FL 34616. Mail Mar. logs to **Donald Bice W4PCO**, 5511 18th Ave. North, St. Petersburg FL 33710.

FEB 14, 15, 16

MARQUETTE, MI Hiawatha ARC K8LLOD Up 200 Sled Dog Race. 20-80 meters, General. For a certificate, send an SASE to **N8BGA**, 21 Smith Lane, Marquette MI 49855.

FEB 15-16

ALEXANDRIA, VA The Mount Vernon ARC will operate K4EC 1600Z-2200Z Feb. 15-16 to commemorate George Washington's birthday. Operation will be in the lower General 80-15 meter phone subbands and in the Novice 10 meter subband. For a certificate, send your QSL and a 9x12 SASE to **MVARC**, P.O. Box 7234, Alexandria VA 22307. For more information, contact **Mary Pat Nowack KE4QWK**, 703-684-8793. **73**

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Communications Simplified, Part 14

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Although we can calculate the VSWR once we know the load impedance, in practice it is a lot easier to measure it directly. The two most common instruments used are an inexpensive SWR bridge and a much more expensive (and more accurate) device called a through-line wattmeter. The Bird ThruLine meter is the most common brand name of the latter. Both of these work on pretty much the same principle; Fig. 1 shows how the SWR bridge works.

The meter has a metal trough running from one end of the case to the other, with the transmitter and antenna connectors at opposite ends of the case. Running through the trough are the three wires labeled A, B, and C in Fig. 1.

Wire A carries the signal from the transmitter to the antenna. Wires B and C are close to it, but not touching; they are called *sensing wires*.

Let's look at wire B first. Because B is right next to A, there is a small capacitance between the two. This causes wire B to pick up a small amount of signal

from A. But as current goes through wire A to the antenna, it also generates a small magnetic field. Wire B is in that field, and therefore picks up a small amount of signal from the magnetic field as well. The polarity of the signal picked up through the capacitance does not depend much on which way the signal is going, but the polarity of the inductively coupled signal does. For an outgoing signal from the transmitter to the antenna, the two voltages add, whereas for the reflected signal, they cancel. Diode D1 therefore gets a signal proportional to the outgoing or forward signal, but ignores the voltage from the reflected signal. In the same way, diode D2 gets a signal proportional to the reflected signal. The two voltages are then rectified and filtered by the two diodes and capacitors, and fed through the FWD-REV switch to the meter.

The secret to the measurement is in the meter's scale calibration, shown in Fig. 2. To use the meter, we first connect it to the transmitter, set the FWD-REV switch to the FWD or Forward position

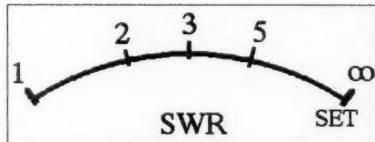


Fig. 2. SWR bridge meter scale.

and turn on the transmitter. Then we set the CALibrate control so that the meter reads full-scale; there is usually a small SET mark at the right end of the scale. Regardless of how much power or voltage the transmitter is sending out, this calibrates the SWR bridge to that level.

The next step is to switch the FWD-REV switch to the REVerse setting (without touching the CALibrate control). If all of the power is reflected from the antenna, indicating an infinite VSWR, the reverse voltage is the same as the forward voltage, and thus the meter will read full-scale. So the full-scale end of the scale reads infinity. If, on the other hand, the antenna is a perfect match, then the reverse voltage is zero and the VSWR is 1; hence the left end of the scale reads 1.

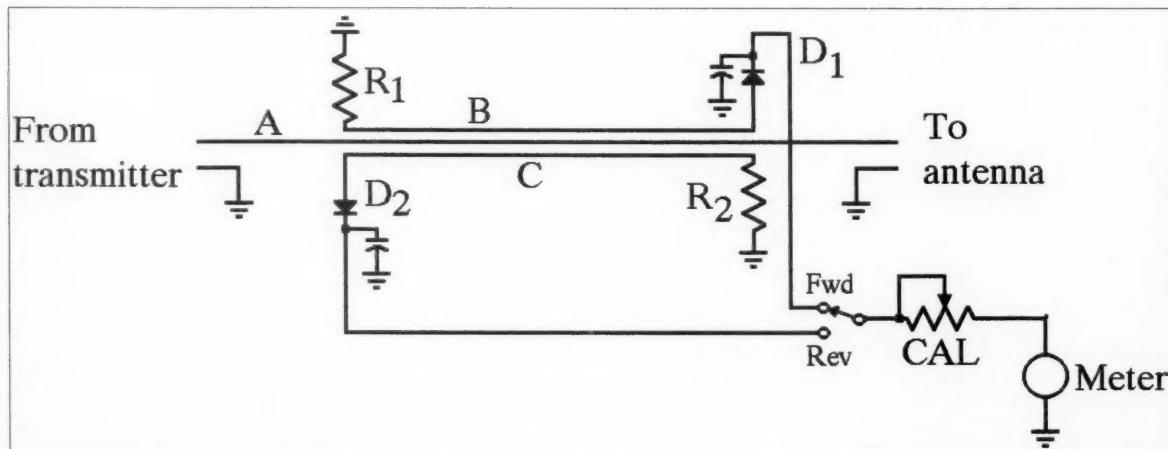


Fig. 1. An SWR bridge.

At the midpoint, the reverse voltage is exactly half of the forward or outgoing voltage. For example, if the outgoing signal is 10 volts and the reverse is 5 volts, the VSWR is then:

$$\text{VSWR} = \frac{V_{\max}}{V_{\min}}$$

$$= \frac{10 + 5}{10 - 5} = \frac{15}{5} = 3$$

so the midpoint reads 3. Since VSWR above 3 is generally considered quite bad, the right half of the scale is usually colored red.

A typical SWR bridge costs \$20-\$30, and covers a fairly limited frequency range. For more accurate measurements, many professionals use the Bird ThruLine Wattmeter. This meter works on the same principle, but instead of having two separate sensing wires, two diodes, and a switch to select them, there is one sensing wire and its diode, mounted in a rotating assembly called a *slug*. The slug has a printed arrow on it, and you rotate it to measure the forward or reverse voltage. The meter is calibrated in watts, rather than in VSWR. Because the reading depends on frequency and power, Bird makes several dozen different slugs for various power and frequency ranges. This makes the power readings quite accurate, but the disadvantage is that you have to calculate your own VSWR from the forward and reverse power readings. (In practice, many technicians take the easy way. If the forward power is "big" and the reverse power is "small," then they are happy!)

One application—a waveguide

The idea that a line shorted at one end can appear open at the other, and vice versa, has some interesting applications. Consider microwaves, for instance.

Microwaves are radio waves that have a very high frequency, typically more than several gigahertz. This also means that they have a very small (micro) wavelength. For example, a signal at 10 GHz has a wavelength of about 1/4". At these frequencies, signals travel only on the surface of wires, not inside them; this is the so-called *skin effect*. A much more severe problem is that most insulators do not

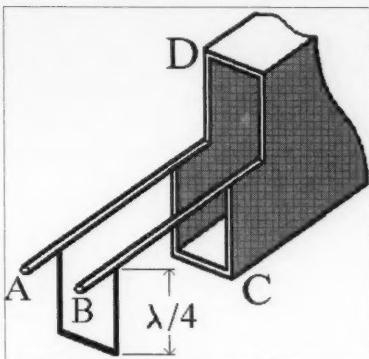


Fig. 3. Making a waveguide.

work very well at these frequencies—they are too lossy. So it is difficult to build a cable to carry them any great distance.

But suppose you used a pair of uninsulated wires (A and B in Fig. 3) held up by a wire loop, as shown at the left of the figure. If the wire loop was exactly 1/4 wavelength long, then its top would appear open even though the bottom is shorted. In other words, a perfect insulator made of metal!

In practice, this is a tad tough to fabricate. But since you can place these wire loops as close together as you want, there is no reason why they cannot be made into the continuous trough shown as C in Fig. 3. To prevent rainwater from collecting inside, we place another identical trough (D) above it, giving us a rectangular pipe called a *waveguide*. The signal simply travels along the inside edge of the pipe, roughly in the middle of the long side, which is now 1/2 wavelength long (1/4 wavelength from the middle toward each end).

The frequency at which the long side of the waveguide is exactly a half-wavelength long is called the *critical frequency*. Frequencies lower than the critical frequency can't make it through the waveguide because the distance from the midpoint to the edge is too small—they get shorted out by the edge of the loop. But frequencies *above* the critical frequency can make it through, simply by traveling a bit closer to the edge.

Most waveguides are fairly small. But if you've ever driven through a long tunnel, you've been inside a large waveguide. You may have noticed that your AM radio goes dead almost as soon as you enter the tunnel, whereas your FM radio only gradually fades out as you go in. The reason is that the typical tunnel is too small to let AM

broadcast signals through. Since the typical AM station has a wavelength of 600 feet or more, the tunnel would need to be more than 300 feet (a half wavelength) in diameter to let the signal in. So AM signals simply don't make it into the tunnel. FM broadcast station frequencies, on the other hand, have a wavelength of about 10 feet, so even the smallest tunnel will let them through.

Tunnels don't really make good waveguides, though, because they are not made of a good conductor. Underwater tunnels are made from short sections of steel pipes, with waterproofing compound joining them so they do not leak. This waterproofing insulates the sections from each other, so FM signals, though they get partway into the tunnel, cannot really travel all the way through. Still, it makes an interesting example.

The idea of radio waves getting through holes is similar. For example, if you wanted to shield a room to prevent radio waves from getting in or out, you could completely encase it in a solid sheet of copper. But this isn't necessary—you can use copper sheet with holes in it, as long as the holes are substantially smaller than 1/2 wavelength. Likewise, the metal sheet covering the window in a microwave oven door has holes that we can see through. But the holes are much smaller than the microwave wavelength, and so the microwave energy cannot get through.

Another application—a stub

A stub is simply a short piece of transmission line. For example, suppose you are trying to receive a particular station, but another strong nearby station is causing interference in your receiver. You therefore decide to filter out the interfering station and keep it out of your receiver.

The simplest (though not necessarily the best) solution is to connect a 1/4-wavelength stub in parallel with your receive antenna. If you leave the far end open, the end connected to your antenna terminals will act as a short and short out the interfering signal. You must keep in mind the velocity factor of the cable to calculate the correct length; in practice, it's probably a good idea to cut the cable a bit too long, and then cut off tiny pieces while observing the interference, until the length is just right.

Transformers for impedance matching

Quite often you need to match one impedance (for example, a 75-ohm cable) to another (such as a 300-ohm antenna). This particular case is a common one with TV antennas; many TV antennas are designed for 300-ohm twin-lead, but used with 75-ohm coax cable.

In this example, there is more than just impedance matching at stake. Coax cable is unbalanced (the signal travels on the inner wire, while the outer shield should be at ground potential), whereas most TV antennas are balanced (both connections carry the signal, but out of phase with each other.) Such transformers are also often called *baluns*, because they connect between a balanced and an unbalanced device.

Matching transformers are readily available just for this purpose. The ones for TV use are cheap because only low power is involved; the ones for transmitting applications must handle the full transmitter power and so they are bigger and more expensive.

Fig. 4 shows the wiring of a typical TV balun transformer designed to match 75-ohm coax to a 300-ohm balanced antenna. The transformer consists of two wire windings, wound near or over each other. Since the impedance ratio of the two windings of a transformer is the square of the turns ratio (the ratio of the number of turns on the primary and secondary), for a 300-to-75-ohm impedance match (a ratio of 4-to-1), we need a turns ratio of 2-to-1. So the 300-ohm side of the transformer has twice as many turns as the 75-ohm side.

The matching transformer in **Fig. 4** has the advantage of being usable over a wide range of frequencies. But if you only need to match at one specific frequency, you can use a length of transmission line instead.

We've now learned that a 1/4-wavelength cable can change a short into an open, or vice versa. But there's more to it than that. If the characteristic impedance of the cable is Z_0 and the load on its output is Z_{load} , then the impedance Z_{in} you see looking into the cable is:

$$Z_{in} = \frac{Z_0^2}{Z_{load}}$$

Notice that this makes sense: if Z_{load} is an open (infinite impedance), then Z_{in} is a short (zero impedance). If Z_{load} is a short (zero impedance), then Z_{in} is an open (infinite impedance). And if Z_{load} is equal to Z_0 , then Z_{in} is also Z_0 . So far so good.

But we can take this equation and rewrite it as:

$$Z_0^2 = Z_{load} \times Z_{in}$$

$$Z_0 = \sqrt{Z_{load} \times Z_{in}}$$

So if we want to connect a load Z_{load} of 300 ohms to a 75-ohm input Z_{in} , all we have to do is connect a 1/4-wavelength line between them whose characteristic impedance is:

$$Z_0 = \sqrt{Z_{load} \times Z_{in}} = \sqrt{300 \times 75} \\ = 150 \text{ ohms}$$

With the 300-ohm load on a 1/4-wave section of line having a 150-ohm characteristic impedance, the input into the line will look like 75 ohms, a perfect match.

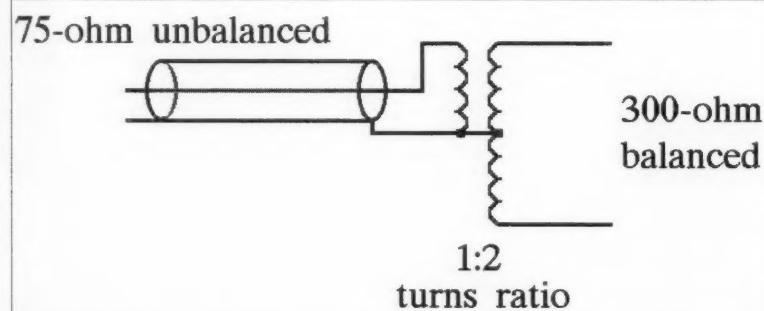


Fig. 4. 300-75-ohm balun.

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There are two catches, of course—this will only work at the one frequency that the line is cut for, and you cannot mix a balanced line with an unbalanced line. So this is totally unusable for the typical TV application. But it is perfectly suited for those single-frequency applications in communications.

Last thoughts

There is one other idea that should be covered, but that didn't somehow fit into any of the previous sections. In a balanced transmission line (such as the 300-ohm twin lead used in TV antennas), it's obvious that the signal travels along both conductors. But many people believe that in coax the entire signal travels only along the inside conductor, and the shield is there only for the ride, so to speak—to keep outside signals out, and inside signals in. Not so.

If you place a load, such as a resistor, at the end of a line, the only way to get a current to flow in the resistor is to have both ends of it connected to *something*. Whatever current flows into the resistor from the center conductor must flow out the other end, and into the shield. So the shield takes an active part in the process. This will be an important concept in the next article in this series, when we talk about antennas. An antenna cannot connect just to the center conductor of the coax because then the current has nowhere to go. There must be a solid connection from the coax shield to some active part of the antenna so that current can return along the shield.

Summary

Our treatment of transmission lines has been a very brief, simplified one. There's a lot more to this subject. For one thing, we've assumed that our transmission lines have no loss. That's not true; the loss changes the results somewhat, and usually must be taken into account.

More important, even though we've used the symbol Z in our calculations to keep things general (and to use the same symbols as most other books and articles), we've ignored the fact that these are really impedances—we've made believe that all the Z's have been pure resistances. That makes things simple, but is not exactly realistic. But at this point I will use the standard excuse you'll find in many books: "More advanced treatment is beyond the scope of this article."

QRP T-R Circuit

It's simple and versatile.

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Have you been looking for a simple T-R circuit for your QRP transceiver project? I too was faced with this problem recently. I wanted something that was simple, would work for several different bands, and would not add significantly to battery drain.

Most of the current crop of QRP designs and kits are of the single-band variety and use the L-C series traps method of automatically isolating the receiver input from the antenna when the transmitter is keyed. This is a great and simple method; however, the L-C network is specific for each separate band. I was working on a multibander so I wanted a circuit that would work for all bands without modification or duplication. I also wanted near QSK performance for quick changeover, not between CW characters but between words or pauses. I decided what I really needed was a reed relay circuit that would utilize a normally closed contact to keep the antenna connected to the receiver with no current flow at all during receive periods.

Reed relays have very fast switching times and also have high coil resistance. This means low current flow, especially compared to what a rig draws anyway on transmit. These relays typically draw only 15 milliamperes or less operated at 12 VDC.

The circuit

Fig. 1 shows the circuit I developed. The circuit is activated from the key line on your rig. This is the line that goes to ground potential when your rig is keyed. This comes straight from your key jack; either your hand key or your keyer, when

activated, causes this line to go to ground. This in turn causes a keying transistor to turn on, applying 12 volts to various parts of your transmitter circuitry.

In **Fig. 1**, nearly the same thing happens as in your transmitter. When A is grounded, Q1 turns *on*. This applies +12 volts to the coil of RLY1. Since this is a very fast relay, it immediately opens the contact separating the receiver from the antenna. Note that the Q1 circuit does not contain any timing or shaping capacitors like your switching transistor in your transmitter circuit does. This is because we want RLY1 to pick up immediately before the transmitter is turned on. Otherwise we may pump some transmitter power into the receiver, causing some serious problems!

Q1 also applies voltage to capacitor C1 through resistor R1, causing it to charge. This is the dropout timing circuit. When Q1 returns to normal, C1 discharges through R1 and the relay coil. C1 and R1 are chosen to keep the relay pulled in through a normal string of dits and dahs, but to drop out on pauses or between words.

If you wish a longer dropout period, simply increase C1 to 330 μ F or 470 μ F. Reduce C1 for a quicker QSK type response. R1's purpose is to make sure that RLY1 receives full voltage immediately (not dragged down by charging C1) upon energization, so pickup is quick.

The relay

The relay specified has a 1,000 ohm

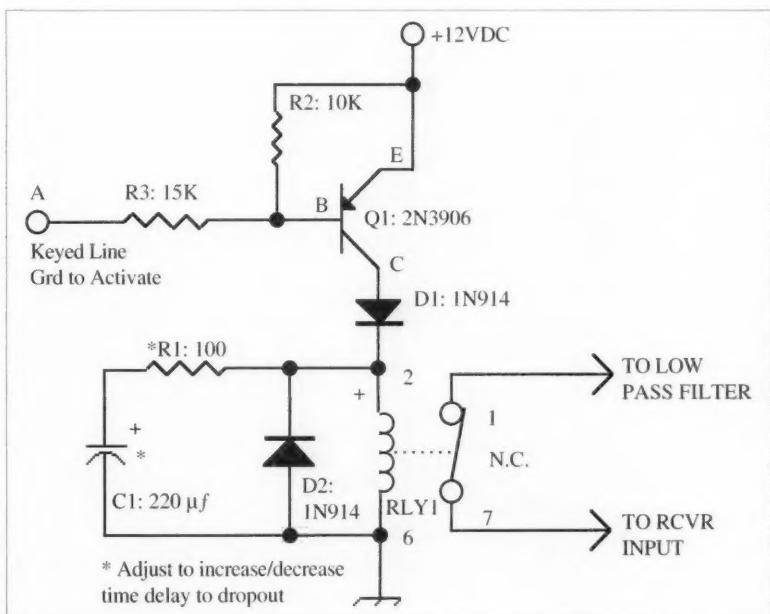


Fig. 1. T-R antenna changeover circuit.

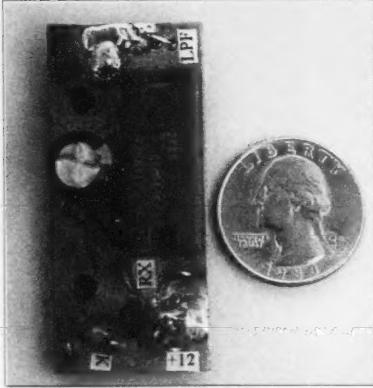


Photo A. The T-R board shown before installation, resting on top of the case for the rig.

coil. Energized, it will draw about 12 milliamperes. I am currently using a relay with a coil that measures 800 ohms and the values specified are right for my normal keying speeds. Feel free to experiment with whatever relay you chose by varying C1 and R1, but do not lower R1 very much because you want RLY1 to pick up immediately.

A word about reed relays—they come in several different forms. Most have one normally open contact. You want one

with a normally closed contact for this circuit, so check it out with your ohmmeter. Also, some reed relays have a built-in suppression diode (D2). In this case you don't need to include D2 in your circuit (but it won't hurt if you are unsure). D2 provides a safe path for the energy stored in the coil to dissipate when the coil is de-energized. Some reed relays are polarized. Be sure the (+) mark is towards Q1 if the relay you use has a polarizing mark.

Test your relay by connecting your ohmmeter across the contacts and energizing the coil from a 12 volt supply. Watch for polarity before you connect the coil to the supply. When you energize, the contact should open and the meter reading go from zero to infinity.

Reed relays have long life expectancies. The relay specified is good for 100 million operations when switched *dry*. (That *dry* means when the contacts do not have to switch current other than very small signal values, like we are doing.) For the worst-case scenario, if you transmitted 24 hours straight every day for an entire year, at 15 wpm, using full QSK, you would just barely exceed 100 million operations. For us less active

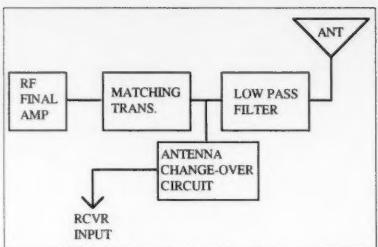


Fig. 2. Hookup.

operators, this relay should have a long life span.

Construction and testing

All parts other than the relay are garden variety. Just about any small PNP silicon switching or small signal transistor will work for Q1. The diodes are silicon small signal or even small rectifier diodes. C1 should have a 25 volt rating to be safe.

I built my T-R circuit on a little scrap of printed circuit board measuring about 2 inches by 1 inch. I just gouged out some isolated pads for each connection pad and drilled holes with my Dremel™ tool. A small perfboard or Radio Shack™ pre-drilled project board (RS #276-159) will work great. The Radio Shack board will accept the relay pins directly, making things easy.

Hookup and testing are easy. Connect a 12 volt supply to the circuit. Again hook up the ohmmeter across the contacts. Ground "A" and see that the contact opens immediately but closes back after a short delay. You will need an analog ohmmeter to see the pickup and delay because most digital meters take a while for the reading to change. Then hook a jumper from your key line in your rig to "A." Send a string of dots and dashes. You should aim to have the relay stay picked up between characters but to drop out on pauses. If your operating habit is such that you would like the relay to hang in between words, increase C1 substantially. Otherwise small changes will take care of things.

Be sure that when messing with your rig you have a dummy load connected or you remove the 12 volt supply from the output transistor. You wouldn't want to blow up the final because you didn't have an antenna connected. Now build the circuit into your transceiver. Connect one side of the relay contact to the spot between your low-pass filter and the

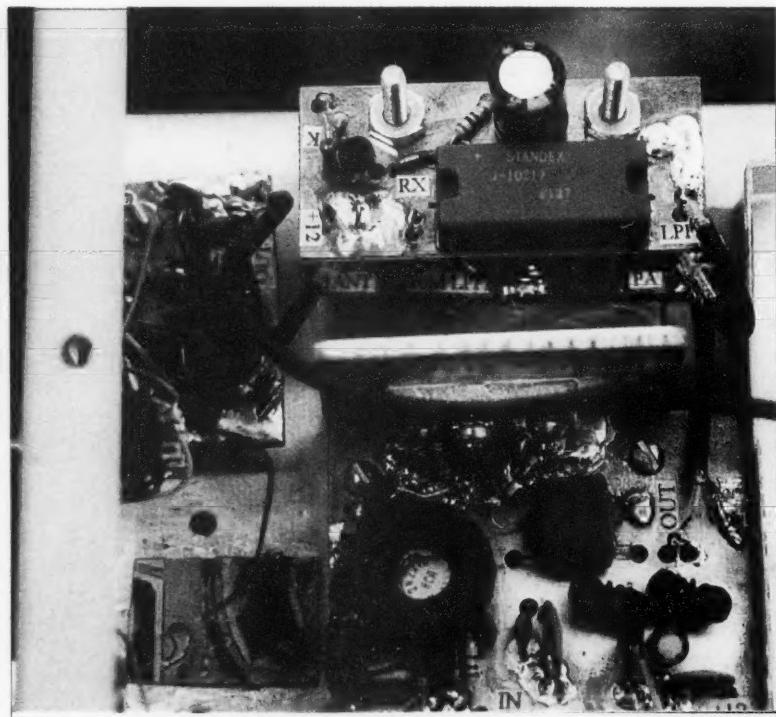


Photo B. The T-R Board (upper center) installed in a portable rig. Directly below are the PA and driver boards. The low-pass filter is located on a board underneath the T-R board.

power amplifier matching transformer, or between the low-pass filter and the power amplifier itself if no matching transformer is used. The other side goes to the receiver input. That's it!

You now have a very simple circuit that works great. It works for any of the HF bands without modification, and you learned a little about circuit design in the process.

Elegant Rotating—Revisited

Continued from page 20

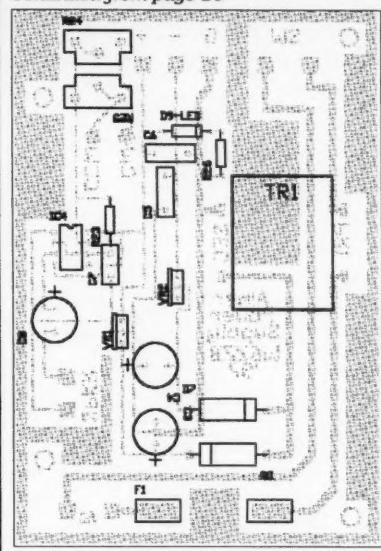


Fig. 7. Component side of the power supply board and placement of the components (not to scale).

73 wants your feedback...we've been improving 73 for the past months with more articles, easier reading type, etc. And honestly, we *need* your feedback (in detail) if you have any critique either for or against the subtle changes that we've made. We know we can't please everyone every time, but if you tell us what you want 73 to be, we'll at least try to head in the direction for further "improvements" that might be most appealing to you. Thanks.

NEVER SAY DIE

Continued from page 55

64-page book of 60 of my editorial segments which hadn't yet been in 73.

All this got started with my first RTTY newsletter, 45 years ago. I was inspired by the John Campbell W2ZGU editorials in *Analog*. Well, it used to be *Astounding Stories*. Unlike any other magazine I've seen, John wrote long editorials about anything he thought the readers might find interesting. I started reading his editorials around 1938, when I got interested in science fiction. Unfortunately John smoked, so he died relatively young, robbing the world of a lot of entertainment. If you find yourself near an antiquarian book store, look for a 1966 Doubleday book of John's collected editorials. You'll treasure it.

As John wrote in his March 1965 editorial, "Editorially I shall continue to try to investigate the nature of the stuffing in any suspiciously bulging shirts around. My business is directly concerned with the progress and achievement of the human race;

any orthodoxy that tends to sidetrack or otherwise impede progress is interfering with my business, and I'll do what I can to sabotage them." You could do worse than follow in his footsteps. Just because a lot of people believe something doesn't make it true. In fact, the likelihood is that it isn't true.

Are you still just sitting there? Get cracking! Let's see what you can do. But please be sure to do your homework before you write. Know what you are writing about.

Placebos

Back when cortisone first became available an arthritis patient pleaded with her doctor to let her have some. The doctor said that, well, cortisone was hard to get, but he had a new remedy that was supposed to be almost as good. For four weeks he gave her cortisone shots, telling her it was the new remedy. She showed no improvement. Then he said that the cortisone had finally come in and showed her the ampule. But he switched to a sterile saline solution for her

Continued on page 77

Parts for Almer Board	
R1	25k linear pot
R12, R14, R19, R21, R22	1k, 1/4 watt
R2, R11, R13, R18, R20	10k, 1/4 watt
R16, R17	15k, 1/4 watt
R10, R15	75k, 1/4 watt
R3, R6	100k, 1/4 watt
R4, R5	1 meg, 1/4 watt
R7, R8	20k PCB pot
R9	1 meg PCB pot
C1	22 µF, 25 volt
C2	5 µF, 25 volt
D1, D2, D3, D4	1N914
D5, D6	LEDs, any color
IC1, IC2, IC3	LM311
Q1, Q2, Q3	2N2222 NPN trans.
K1, K2, K3	Radio Shack #275-214 4PDT relay, 12 VDC coil
J1 - J9	Wire jumpers
Parts for Power Supply and Audio Oscillator	
TR1	12 volts, 300 mA, RS #273-1385
Voltage regulator	+12 volts, 7812
Voltage regulator	-12 volts, 7912
D7, D8	1N4001 50 PIV
C3, C4	1,000 µF, 25 volts
IC4	LM555
C5, C6	0.1 µF
C7	0.1 µF, 25 volts
C8	10 µF, 25 volts
Miscellaneous Parts	
1/8 amp fuse and holder, appropriate switch and power cord	

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In Search of Higher Power

... and a safe connection for it.

Robert W. Vreeland W6YBT
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San Francisco CA 94127

Recently I saw an ad for a neat little 500 watt PEP mobile amplifier. It looked like a great way to get in some really high powered 75 meter mobile. Then I thought about how I would get power from the car battery to the amplifier, which required 13.8 volts at 80 amps peak. Supposing that the total resistance of the cables plus contact resistance was 0.02 ohms (not an unreasonable assumption), the

MOSFETs

Probably the first really good RF power transistors were made by the Amperex division of Phillips. With a 28 volt supply, their BLX14 put out 50 watts PEP. The BLX15 put out an astounding 150 watts using a 50 volt power source.

Most manufacturers saw more money in the 12 volt mobile market and neglected the

"Most manufacturers saw more money in the 12 volt mobile market and neglected the high voltage high efficiency field."

peak IR drop would then be 80 times 0.02, or 1.6 volts. This would leave 13.8 minus 1.6, or 12.2 volts to power the amplifier; not good, but I could probably live with it.

Next I thought about the PR power lost in the cables and connections. It would be 80² times 0.02, or 128 watts! This might even start a fire. The problem is not with the amplifier, but rather with the method of connecting it to power. Obviously, high power 12 volt equipment requires special care in installation.

The options

What about a solid-state 120 volt powered linear for home use? There are several on the market, but they are all very expensive. One in particular caught my eye. It is rated at a full kilowatt output at 100 percent duty. What a beautiful unit! In order to achieve such high output, they used 48 separate MOSFETs. No wonder it costs well over \$4,000.

There are a number of vacuum tube linears in the under-\$2,000 price class. What do the vacuum tube people know that the solid-state manufacturers may not? More than 50 years ago they learned that the way to increase output is to raise the voltage, not the current. High current means high component losses.

high voltage high efficiency field, but at least one manufacturer has introduced a line of high power RF MOSFETs designed for use with a 50 volt supply. This is definitely a step in the right direction. The catch is that inside what looks like a single transistor there is a whole bunch of separate MOSFETs, each with its own gate and source connecting wires—a very expensive type of construction.

What about really high voltage MOSFETs? There are 600 and even 800 volt models available. They are used in low frequency switching applications. The problem is that they are generally not designed for RF use. They usually have very high input and output capacitances and a slow rise time. Well, not always. A company called Supertex (1235 Bordeaux Drive, Sunnyvale, CA 94089) has developed a proprietary process whereby they can reduce the capacitances and the rise time.

Although they are not in the really high powered transistor business, they have a couple of 600 volt MOSFETs that offer exciting possibilities. These are the VN0360N1 and the VN0660N5. I have used the VN0360N1 in an amplifier for 80, 40, and 20 meters¹. For improved

performance on 20 meters, I used the VN0660N5. It is a somewhat lower powered device with a better rise time and lower capacitances.

One nice thing about 600 volt MOSFETs is that they are high impedance devices and are therefore suitable for use in tuned amplifiers. Another advantage is that they can be powered by the rectified and filtered 120 volt line without the need for a power transformer. My 20 meter amplifier uses a pair of VN0660N5s in a tuned push-pull circuit^{2,3}. It was designed to run AC-DC style on the 120 volt power line. At 27 watts output, it runs at 45 percent efficiency.

Actually, my design was quite conservative. A pair of VN0660N5s could handle substantially more power. They are designed to dissipate 45 watts each at 25°C. The rated DC drain current is three-quarters of an amp. Another advantage is their price. At about \$2.25 each, you could afford to use multiple transistors for high power.

Considering the length of time that transistors have been around, it is sad that progress in the RF power field has been so slow. Perhaps it is time for hams to take the lead again. So get out your calculator and soldering iron and go to work!

References:

1. Vreeland, R.W., W6YBT, "Notes on a Lightweight Portable CW Transmitter with a Transformerless Power Supply," *QEX*, June 1988, pp. 11-13.
2. Vreeland, R.W., W6YBT, "More Gadgets for your MFJ-9020," *73*, October 1993, pp. 10-12.
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Antenna? What Antenna?

A stealth antenna farm for a small lot.

J. Frank Brumbaugh KB4ZGC
P.O. Box 30, c/o Defendini
Salinas PR 00751-0030

Is an efficient antenna farm possible on a small lot? Yes, if you are willing to confine your operation to the seven ham bands from 40 through 10 meters, and are also willing to tweak an antenna tuner, which may be automatic or manually operated. With the new sunspot cycle just now beginning, these are the bands where the DX will be, where it will be easier to earn WAS, and where there will be many opportunities for casual rag-chewing.

But is it *really* a stealth installation that the neighbors won't notice? And how about restrictions against even TV antennas? How can this be possible?

Yes, it can be made "invisible" to neighbors, inspectors and casual passersby, even though it's right in view all the time. First I'll show you how to build it, then I'll show you some ways to completely fool anyone looking for an antenna. In fact, even another ham who did not read this article would never guess you had an efficient antenna farm while he was looking right at it. Now, that is about as stealthy as you can get—and still work the whole world.

The antenna farm

The antenna farm described here requires only three dipoles to cover all seven ham bands efficiently. All are slightly shorter than full-sized dipoles, but there are no traps—nothing fancy, just wire dipoles. They can be installed and fed separately, although this could take them out of the stealth category. They can also be installed horizontally and fed in parallel with a single feedline. I don't recommend either of these options; it is difficult to hide antennas

which *look* like antennas even to a non-technical person.

I recommend installing the three dipoles as inverted vees using a common high support at the apex, which can be a mast, pole, tree, or anything else which is high enough. Also, I recommend feeding all three dipoles in parallel with a single feedline. Best of all, the

"Your stealth installation can be made 'invisible' to neighbors, inspectors and casual passersby, even though it is right in view all the time."

recommended dipole lengths are all somewhat shorter than full half-waves and, while not resonant in any band, are easily and efficiently matched with any antenna tuner because all dipoles are close to the adjacent bands they are designed to cover.

What you will need

115 feet of antenna wire is sufficient to make all three dipoles, with plenty of

wire left to make connections to the insulators. The center frequency of each dipole was carefully chosen so it will cover two or three adjacent bands, as listed in **Table 1**.

Feeders

I strongly recommend using 300- or 450-ohm open-wire feedline instead of coax. Because these dipoles are not resonant in any ham band covered there will be varying amounts of reactance at the center of each dipole. Feeding a reactive load will cause standing waves on the feedline, and power will be reflected.

This reflected power is subject to the same line losses as the forward power. Once it reflects back to the transmitter it is again reflected up the line to the antenna, where most of it is radiated and a small portion is reflected back once again to the transmitter. If coax feeders were used the I²R losses would be much greater, and more power would be consumed in the coax on this back-and-forth trip. This situation occurs even with a 1:1 match at the antenna tuner, since the tuner is only tuning the rig to the line, not the line to the antenna itself. In other

Bands Covered	Dipole Overall Length	Length, Each Half
40 - 30 m	54 ft. 6 in.	27 ft. 3 in.
20 - 17 - 15 m	26 ft. 4 in.	13 ft. 2 in.
12 - 10 m	17 ft. 6 in.	8 ft. 9 in.

Table 1. Center frequency of each dipole was carefully chosen so it will cover two or three adjacent bands.

words, standing waves will occur on the line regardless of what type of antenna tuner is used.

Although similar standing waves and reflected power will occur on open wire feeders, the line loss is much less as the I^2R losses are so low as to be almost inconsequential. Remember that reflected power is always returned back to the antenna, *minus I^2R losses*, and re-radiated, *minus the power reflected* due to the line/antenna mismatch. This means that reflected power is not "lost" power—it is only lost when using a high loss feedline like coax, rather than the low loss ladder line.

Installation

Because every ham knows how to erect a dipole, either horizontally or as an inverted vee, and will do so if separately installed and fed dipoles are desired, I will describe only an

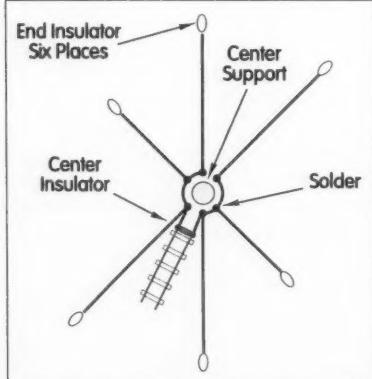


Fig. 1. Bird's-eye view of the triple-dipole antenna installation.

easily-hidden installation with all dipoles erected as inverted vees and all using the same single support and fed in parallel with open-wire feeders. See Fig. 1, which shows the completed installation as viewed from directly above the central support.

Seven insulators will be required: one at the common feed point, and one at each end of the three dipoles. Black braided Dacron® line about 3/16" in diameter should be used between each end insulator and its support point. The supports can be stakes driven into the ground, a hook on the side of a house or garage, a fence post, a tree—whatever is handy.

Although the 60° spacing shown in the bird's-eye view of the antenna installation is ideal, it is not a law of physics. Just space the halves of the antennas the best you can in the space available. The 60° spacing provides the least possible interaction between the dipole in use and the remaining two.

As the ends of the antennas are brought downward to tie off the ends to form inverted vees, do your best to

have an included angle at the apex of each dipole of between 90° and 110°. Again, if space requires a somewhat greater or lesser apex angle, do the best you can.

Be certain the ends of the antenna wires are not less than six feet, and preferably somewhat higher, above ground. This keeps anyone from coming in contact with RF on the ends of the antenna.

Make sure the halves of each half-dipole are connected together at the feed-point insulator (see Fig. 2).

Tuning up

Your antenna tuner may or may not include a 4:1 unbalanced-to-balanced balun to match the unbalanced tuner output to the balanced feeders. If it does not, and all or most automatic

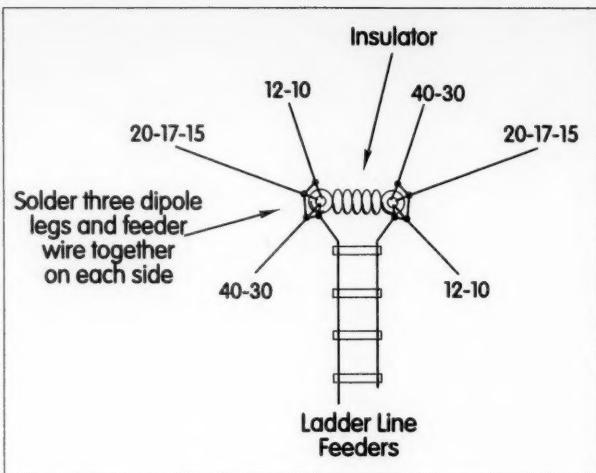


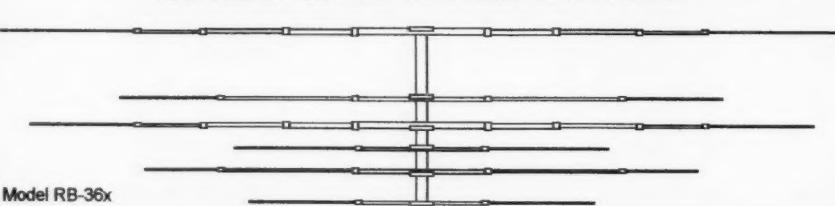
Fig. 2. Center insulator detail.

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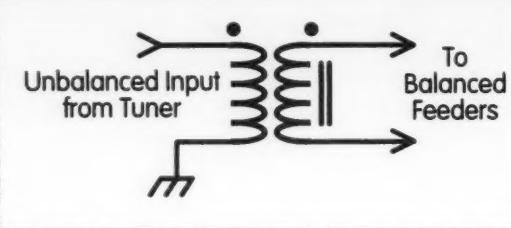


Fig. 3. Unbalanced-to-balanced 1:1 balun.

antenna tuners do not, you should build a balun to feed your antenna farm. Because the resistive component of the feed-point impedance on all bands is not too high, I suggest building an unbalanced-to-balanced 1:1 balun.

Caution: Be sure to use a core large enough for the level of RF power your transmitter produces. This is extremely important!

Fig. 3 illustrates the winding of a recommended 1:1 balun. It is bifilar-wound with enamel-covered copper wire of a size appropriate to your power output. For high power it is a

0.075 mH (75 μ H). The AL values differ for each size core and type of mix. Cores and a catalog sheet giving AL values and other information are available from Amidon Associates, Box 258867, Santa Ana CA 92799.

$$\text{Turns} = 10^3 \sqrt{\frac{mH}{AL}}$$

Another source of a complete line of toroids is Palomar Engineers, Box 455, Escondido CA 92025.

Hiding in plain sight

Depending upon many things, including the sensibilities of nearby neighbors and/or homeowners' association restrictions, you may find it necessary to camouflage your antenna farm without compromising the efficiency of its radiation. One of the best ways to camouflage the mast or pole supporting the feed point of your antennas is simply to place a birdhouse on top. Thus, your antenna mount has disappeared, while remaining in full view.

The antenna wires themselves escape notice, masquerading as guys stabilizing your lofty birdhouse. The end insulators, if they are white porcelain or glass, can be sprayed with black enamel. When the enamel is dry, rub a thin coat of silicone grease over the outer surface of each insulator to preclude any bridging of the insulators by rain. Dow Corning DC-3 or DC-4, or any product labeled "heat-sink compound" which does not contain white zinc oxide, are all good silicone greases.

Now that only you can see your antenna farm, the problem of bringing open-wire feeders from just below your birdhouse to the shack is more difficult. You might get away with explaining that the ladder line is actually a ladder for the use of birds with crippled wings. Don't take the easy way out, it won't be that difficult.

Parts List

- 115 feet of antenna wire
- 1 center insulator (feedpoint)
- 6 end insulators
- Black braided Dacron® rope, 3/16" diameter
- 1 unbalanced to balanced 1:1 balun (see text)

Bring the ladder line vertically down the birdhouse pole, stapling it occasionally through the insulation, or use hot glue. Paint the line the same color as the pole, at least as high as you can reach standing on a kitchen chair. Adults will never notice it, because few adults pay any attention to anything much above eye level.

The ladder line now will probably have to be routed through a length of PVC pipe from the pole to the shack wall, but it's not a good idea to have your feeders close to the ground. The pipe should be more than head-height above the ground and be painted to match the general area, perhaps even mottled to break up its lines.

The pipe containing the feeders, if supported by a few uprights which have vines planted around them, will turn this part of your feedline into a growing frame for grapes, flowering vines, pole beans etc. It might also be a good idea to temporarily wind some plastic vines around the uprights and feeder pipe as immediate camouflage.

Plastic vines can also be wound through ladder line and the feeders taken directly from the pole into a second-floor shack, though this might invite comment.

If you want to find out just how stealthy you have made your antenna farm, invite a ham who has not read this article to your home and "cry on his shoulder" a bit about the antenna restrictions and not being able to put up a decent antenna and see what suggestions he has to offer. Take him into the yard and ask for ideas. He probably will suggest a vertical attached to the side of the birdhouse pole. Then take him into the shack, turn the rig on, and let him be amazed at what he can hear as you have a QSO or two. Then, just to be friendly, tell him who told you how to do it.

Because each stealth antenna farm will be different, use your imagination. I've offered a few hints here, but you'll probably have even better ideas. And maybe you'll write about 'em.

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Hentenna Footnotes

Using an EZNEC model to build a sample.

Thomas M. Hart AD1B
54 Hermaine Ave.
Dedham MA 02026

I like antennas and antenna articles. Recently, I have discovered the joys of modeling antenna designs on the computer with the EZNEC program (available from Roy Lewallen W7EL, P.O. Box 6658, Beaverton OR 97007; phone 503-646-2885, FAX 503-671-9046, E-mail w7el@teleport.com), and only building samples if the results look promising.

73 printed an interesting article by KAØDAQ in the April 1996 issue, titled "The Hentenna." For the first time, I found a complete set of formulas in print that helped in the design work.

In order to learn more about the Hentenna, I reviewed my own antenna references, ran a model on EZNEC, and built a sample for the FM broadcast band.

Evolution of the Hentenna

A book, now long out of print, *Radio Amateur's VHF Manual* (©1972, ARRL), describes the "Skeleton" or "Slot" antenna based on designs by B. Sykes G2HCG. The illustration shows the process that changed two horizontal half-wave dipoles into the final rectangular Hentenna design. The antenna was popular at the time of publication and a commercial model was marketed by J-Beams Ltd. The antenna is characterized as horizontally polarized, with vertical sections that act as wide-spaced transmission lines.

Etymology of "Hentenna"

"Hen" comes from the Japanese word for "interesting" or "unusual." In an article titled "Let's Make the 'Hentenna'" (*QST*, February 1982), Koji Sugihara

Hentenna Computations				
MHz	1/2 WL	1/6 WL	Total Wire	Feed Point
146.0	3.4	1.1	11.5	0.8 Feet
	41.3	13.8	137.7	9.6 Inches
90.9	5.5	1.8	18.4	1.3 Feet
	66.3	22.1	221.1	15.5 Inches
50.1	10.0	3.3	33.4	2.3 Feet
	120.4	40.1	401.2	28.1 Inches
29.5	17.0	5.7	56.8	4.0 Feet
	204.4	68.1	681.4	47.8 Inches
28.4	17.7	5.9	59.0	4.1 Feet
	212.3	70.8	707.7	49.6 Inches
21.3	23.6	7.9	78.6	5.5 Feet
	283.1	94.4	943.7	66.1 Inches
14.2	35.4	11.8	118.0	8.3 Feet
	424.6	141.5	1,415.5	99.2 Inches
7.2	69.8	23.3	232.6	16.3 Feet
	837.5	279.2	2,791.7	195.7 Inches
3.6	139.6	46.5	465.3	32.6 Feet
	1,675.0	558.3	5,583.3	391.4 Inches
1.8	276.1	92.0	920.3	64.5 Feet
	3,313.2	1,104.4	11,044.0	774.1 Inches

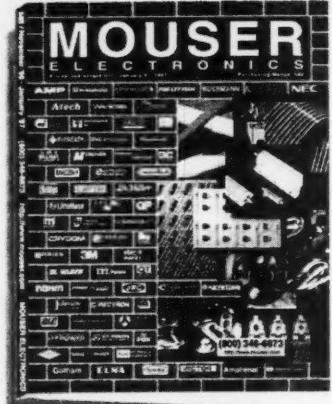
JJ1UMS stated that the design was very popular on 6 meters (about 10% of the installed base). Horizontally polarized, the antenna was very forgiving about dimensions; a 5-10% variance from design specifications had little effect. The antenna could be fed with either 50 or 72 ohm coax, directly or with a balun. The feed point was a Y-shaped wire that

was moved up and down to determine best match before final attachment.

Dimensions

Table 1 shows the lengths of the sides, as well as feed point location, based on the experiments by KAØDAQ. Clearly, the antenna is best suited to 10 meters and above. It would be possible to try

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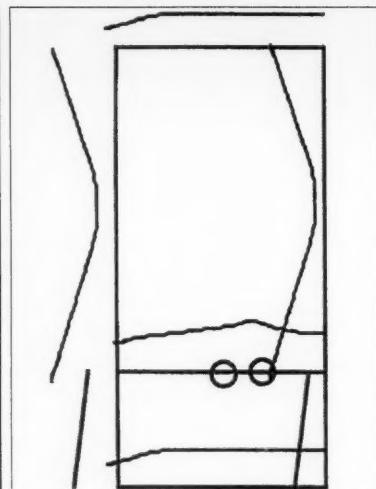


Fig. 1. Currents on the antenna during operation.

one on 15 and 20 meters, but the structure starts growing large here. Hentennas on 40 through 160 meters are well out of the ordinary person's reach. I had no problem constructing and using a sample on 90.9 MHz, the local National Public Radio Station, WBUR in Boston. It works!

The 10 meter report

Bill Orr W6SAI included an illustration and discussion of the Hentenna in his monthly column in *Ham Radio* magazine, May 1989. He discussed a letter from JE1DEN which contained information on using the design on the 10 meter band in Japan.

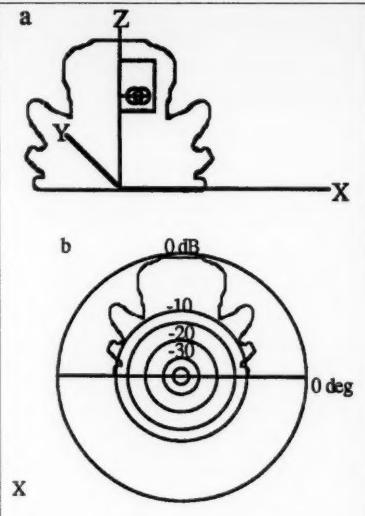


Fig. 3. EZNEC elevation plot in the plane of the Hentenna.

EZNEC report

Fig. 1 shows the currents on the antenna during operation. Next, elevation plots were prepared to show that the

"The Hentenna is a very interesting, often overlooked, design that can be used on HF and VHF installations."

strongest radiation is perpendicular to the plane of the antenna. The takeoff angle is 11 degrees in the sample, favoring distance work. The elevation pattern in the plane of the antenna is, as expected, attenuated and provides a high takeoff angle of 81 degrees.

Switching to the azimuth plot, we find a very pronounced figure-eight pattern. This has been reported in the literature and supports the elevation plot data. The Hentenna is strongly directional and can be used with parasitic elements.

Polarity considerations

The Hentenna is horizontally polarized. Does this matter? The answer is "maybe." If you operate on the HF bands and depend on the ionosphere, the answer is probably an unqualified "no." Refer to the *ARRL Antenna Book* (©1994, ARRL). Here, we find that in the range from 3 to 30 MHz, skywave transmissions change their polarizations.

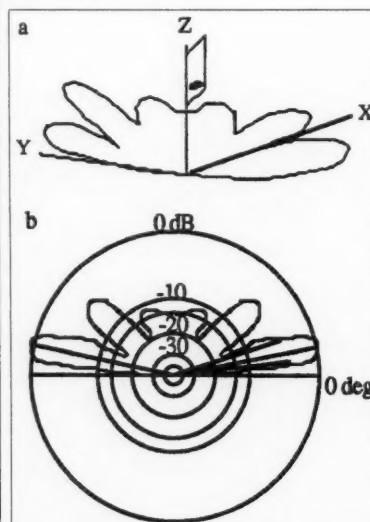


Fig. 2. EZNEC elevation plot, perpendicular to antenna plane.

Antennas at either end of the connection don't need to have the same polarization.

For short-path communications, VHF FM work for example, polarization may be quite important. Cross polarization can result in 20 dB losses in cases where different methods are in use at the transmitter and receiver.

Conclusions

The Hentenna is a very interesting, often overlooked, design that can be used on HF and VHF installations. The literature contains references to installations on 10, 6 and 2 meters. The structure is simple and rugged when properly assembled. The horizontal polarization may be a concern in VHF use, especially on repeater work. This design is one that should not be overlooked when planning additions to the antenna farm, or in my case, antenna garden (I have too little space to build a farm!).

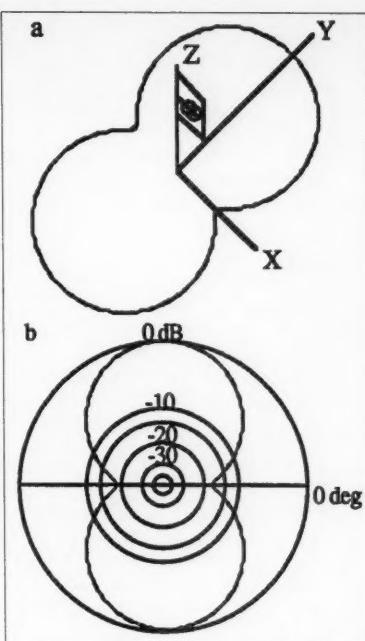


Fig. 4. EZNEC azimuth plot of the Hentenna.

NEVER SAY DIE

Continued from page 69

shots and she showed an immediate and dramatic improvement.

Though the medical literature has thousands of similar stories and doctors are quite familiar with this response, which they call the placebo effect, what they haven't done is find out how and why it works so they can then harness its power to help cure people.

I've seen medical reports saying that the placebo effect can work in up to 80% of all illnesses. But no matter the percentage, here is a way which could help cure a wide range of illnesses that the medical industry is refusing to research and develop. Why? Simple, there isn't any money in selling placebo based cures.

Back when I was a professional psychotherapist I found that every illness had a psychological trigger. By de-activating this trigger the illness would go away. And the de-activating procedure was fairly simple. At the time the medical industry ridiculed the whole idea. In the intervening years doctors have come to admit the importance of psychological components in illnesses, but I defy you to find one doctor anywhere in the world who is making use of this knowledge.

Twenty years ago I suggested in an editorial that one excellent application for personal computers would be to use them in doctors' offices and hospitals to uncover the psychological trigger for illnesses. The procedure is so simple that even a desktop computer, operated by the patient, could be programmed to find these triggers for doctors. There would, I suspect, be a pretty good market for such a computerized diagnosis system.

Then I'd have to write a handbook for doctors on how to de-activate the psychological triggers, since I suspect I'm one of the few people left who know how to do this.

What is Truth?

If I say that I believe that extraterrestrials are and have been among us for thousands of years, is your reaction that poor old Wayne is off his rocker? Or do you agree? And if you think I'm off my rocker, are you at least willing to look at the evidence that convinced me?

Okay, how about telepathy, auras, spoon-bending, psychokinesis? These, too, are subjects that are off-limits for scientific investigation. Not only won't they be funded, ridicule and humiliation await the brave and inquiring.

Now let me be specific. Let's take Uri Geller, for instance. Was he just a stage magician or was he really a psychic? Unless you've done some serious research you probably don't know that Geller performed for scientists under the most carefully controlled laboratory conditions. He has been videotaped while being carefully watched by both professional conjurers and scientists, using no materials provided by him or that he even had prior access to, remotely affecting scientific instruments, even producing objects out of thin air, and locating hidden objects with no errors.

Geller submitted to endless exhaustively controlled experiments at several colleges. For instance, a dozen aluminum film cans would be put on a table. Some had water in

Continued on page 78

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NEVER SAY DIE

Continued from page 77

them, some steel balls, and some sugar cubes. Geller did not touch the cans, but was able to identify the contents in all 12 correctly. The odds were over a million to one. Geller was able to make Geiger counters click, and other scientific instruments give weird readings.

Yes, I agree, I'm off my rocker. But that's because I haven't time to sit around rocking when I prefer rocking the boat. I've a nice rocker—a gift from an appreciative college president for my consulting work for him and the deans. But how can I spend time sitting around rocking in my old age when I feel I should be writing about the anomalies that the scientific establishment is not just ignoring, but is actively trying to prevent being investigated?

Like, did you know that plants somehow communicate via UV? The research results are amazing, but the odds are that you've never seen them published. Ditto the work of Rife, Naessens, Reich, Ott, Backster, Tesla, Rawles & Davis, and a bunch of other martyred scientific pioneers. Books about many of 'em are on my \$5 list of books you're crazy if you don't read. On trips, my suitcases are more loaded down with books I'm reading than clothes. Or are you like the average American schoolteacher, who reads

one book a year (usually fiction)? I read two or three non-fiction books a week. Sure, some are a waste of time, despite high recommendations from readers, but others go from good to superb, with a few making it when I update my book list.

Perhaps you can understand why I see so many pioneering opportunities for anyone with the guts to oppose the scientific mainstream.

Day Care

The election of state senator Jeanne Shaheen to governor of New Hampshire got me to thinking. I worked with Jeanne on the Educational Subcommittee of the New Hampshire Economic Development Commission, so I got to know her pretty well.

Jeanne had a fixation on the need for New Hampshire schools to be legislatively forced to include kindergarten for five-year-olds. I agree that youngsters should be given every opportunity to learn during their early years, but I'm just not a fan of having the government force everyone to do what a legislature has decided is best.

For that matter, I am most critical of the whole "day care" concept. I grant that there may be some day care centers that provide children with the opportunities to learn a wide variety of things. However, I suspect

that most of them operate like the ones I've seen where the children are started early being taught regimentation, and their exposure to new ideas and experiences are limited to what Sesame Street and Mr. Rogers provide.

Here is a time, when kids are two to five years old, when around 90% or so of their lifetime character is being formed. This is a time when they should be provided with the tools and encouragement to learn and experiment.

This is the best time to teach children several languages. This is when they should be helped to experiment with drawing, clay, painting, playing musical instruments, exploring nature, and be taught any skills that may interest them—like juggling, gymnastics, playing games, learning to read, building their vocabularies, skating, skiing, swimming, and so on. This is the time when individual interests should be encouraged rather than group conformity. Between genes and early nurture, everyone is different. But it takes a teacher/salesman to enhance the positives and bring out the uniqueness of each child without stifling their curiosity and enthusiasm.

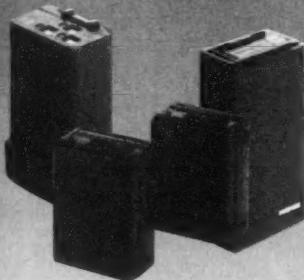
Early animal trainers used punishment as their main method of teaching. Then it was found that far faster and better results were obtained using kindness and reason. This concept has not yet caught on with many teachers and parents. It does require that the teacher be able to outthink the animal (or child) and devise a way to convince the animal that it wants to do what the teacher is encouraging. This results in a happy, cooperative animal. And child.

Perhaps if we change the name of day care centers to early learning centers that would help. Ditto children's garden, a.k.a. kindergarten, which should merely be an extension of the early educational and development process. Given the opportunity, encouragement and the tools, many kids will be able to enter the first grade already accomplished in reading, writing, dancing, acrobatics, playing one or more instruments, able to speak several languages accent-free, be good swimmers, and have already developed several other skills. To do other than this is, to some degree, putting children in straightjackets mentally and developmentally. And remember, that once the window of opportunity for children to learn certain skills has passed, it is a lost opportunity. For instance, never again will children be able to learn many languages as easily. I suspect that musical and dancing skills are the same.

Portable Classrooms

I've proposed that state school systems encourage (and fund) their schools to build portable laboratories into trailers so the facility can be shared by a number of schools. This would make it so that chemistry, woodworking, metalworking, electronics, computer, photography, video production, audio recording, music appreciation, cooking, and other such expensive equipment systems could be shared by several schools, thus

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providing a greater learning experience at a lower cost per student.

I'll bet a good deal of corporate funding could be made available to help build these mobile labs.

For the younger kids this would make a way to bring exploratoriums to them, to provide them access to more expensive musical instruments such as pianos, electronic instruments, and recording facilities.

But how can we bring about the needed change? If you do nothing, nothing will change. If you start pushing for change most people will fight and ridicule you.

Are you a leader or a follower? Our present day care and school system incalculates us early on to be followers. Don't rock the boat. The nail that sticks out gets hammered down. If it ain't broke, don't fix it. Yata-ta, ya-ta-ta. Maybe, if you'll help fix our educational system, we'll have more leaders and fewer followers. Boy, will that screw things up! Ha!

Arrested!

Greg Godsey KF4BDY, a 16-year-old ham from Paulette Court, Kentucky, was arrested while demonstrating the severe weather Skywarn system to a group of people. He was charged with the possession of a police scanner, impersonating a public servant and disorderly conduct. The police confiscated his Radio Shack HTX-202 2m HT.

The HT was later returned when the police found that it was a legitimate piece of ham radio equipment which could not be used to eavesdrop on their communications. But for some reason they'd taken it apart, so it had to be sent back to Radio Shack to be serviced.

And what about the impersonating a public servant deal? Well, Greg had an Amateur Radio Emergency Service ID. But the police and the court refused to accept that ID, so as far as they are concerned a credentialed Amateur Radio Service volunteer is impersonating a public servant and that constitutes an act of disorderly conduct.

Thanks Chicago FM Club *Squelch Tale* for that gem. Remember, the police are your friends and judges are ex-lawyers. However, if you have an ARES card, it can get you arrested. You go to jail and the court collects the \$200.

Nondisclosure Agreement

How'd you like to make a few million bucks? Well, I have an idea for a simple electronic product that'll be easy to make and should sell by the carloads. It could almost revolutionize an industry. We need a manufacturer and a hundred or so sales and service reps.

Now, before I disclose the details of my idea I want it understood that the reading of this constitutes a legal binding contract between you and Wayne Green that you will (a) not disclose this idea to anyone else, and (b) if you decide to get involved in the manufacture or marketing of the products described that you will reserve a

minimum of 2% of gross sales as a royalty for said Wayne Green.

That out of the way, here's the sneaky plan. The germ for this idea was spawned back around 1978 when Sherry and I had lunch with Ed Juge W5TOO at a Mexican restaurant in Ft. Worth.

I'd known Ed for many years. He'd advertised his Juge Electronics store in my magazine and we'd gotten to be friends. Cut to 1975 when I was taking the first issue of my brand-new *Byte* magazine around to drum up advertising. My first stop was with Sphere Computers in Salt Lake City. Then down to Albuquerque to visit Ed Roberts at MITS. From there I stopped at Ft. Worth and dropped off some copies of the magazine with Ed Juge, explaining that I felt that the personal computer field was going to eventually be a huge new business that would eventually be larger than the automobile industry.

Ed bought an Altair 8800 from MITS (the first microcomputer) and was hooked. The ARRL's so-called "incentive licensing" proposal had so gutted the ham business that Ed was fed up and was looking for something new to do. It was at this time that Radio Shack decided to get into the personal computer business. That's a whole story in itself—one that needs to be told. Anyway, since Ed was right there in Ft. Worth, and already had some experience with microcomputers, he joined Radio Shack to help them market their TRS-80 computer. It was a great little computer and, with the help of several thousand stores to sell it, it quickly grabbed the lion's share of the market.

Getting back to that Mexican lunch. This restaurant had a little flag on each table for us to raise when we were ready for more hot *sopaipillas*. Great idea. (Then there was a restaurant in Manchester (NH) that had a light you could switch on to call the waiter. Also a good idea.)

You have the same problems I have. You have to wait for a menu. Then you have to wait for the waiter to notice you're ready to order. When you run short of water or something, getting the attention of the waiter is difficult. The worst is getting the check. At that time the waiter totally disappears as your frustration mounts. It helps you understand why these people are called waiters. They make you wait. And wait. It's no wonder fast food has gotten so popular.

Okay, Gadgeteers

What we need is a beeper system, with one unit attached to your waiter to show the number of the table wanting service, and a unit on your table to call the waiter. Whether it is infra-red or microwave is up to you. It wants to be simple, as inexpensive as possible, legal, fairly foolproof, and not require much service. If there is such a product I haven't seen it at any electronic shows, nor have I heard of any restaurants using one.

Continued on page 81

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The Quest for the Ideal QTH

A New Jersey paradise for this ham.

Bert Simon K2FZ
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At one time my goal was to be the "buzzard on the highest perch." I sought the ideal radio location—and eventually found it, lived on it, and enjoyed every moment of being there.

I laid claim to having the highest permanent resident ham location in New Jersey. The highest point in New Jersey is at an area called High Point, and if my memory serves me right it was in excess of 1,800 feet above sea level. The location I eventually settled for was at 1,240 feet above sea level and was approximately 300 feet above average terrain. A 60-foot tower would put my beam antennas more than 1,300 feet above sea level. Although I worked other stations in New Jersey that were higher, they were Field Day setups—with High Point, of course, being one of the favorites.

It doesn't take a rocket scientist to realize that when it comes to strong ground wave signals, the higher the ground and the clearer the shot means the stronger the signal. And so the search went on to find that elusive higher ground which would lead to a ham paradise, the ideal radio location.

There were other factors to consider. Was the QTH readily accessible without investing thousands of dollars to build a road? Was electrical power available or would I be required to spend additional kilobucks to put in power lines and/or an independent generator? Could I get in and out when the snowstorms arrived? Was it far enough away from the very high voltage power lines which could radiate enough 60-cycle harmonics to bounce signals off Saturn? Were there any restrictions (or possibility of

involving townships or neighbors who might not appreciate the wonders of an antenna farm? At one time I was approached by some township officials who voiced the opinion that "They weren't sure whether they wanted radio towers in their township." I informed them that I had permission from the FCC and the FAA to construct the towers and that was all I needed, but that was then and this is now. I would recommend further study and perhaps some legal advice. The other factor, carrying perhaps

"The band was dead with respect to skip, but on many occasions ZSs would break in just to let me know that I was the only stateside station being heard."

the most significance, was the ability to convince a spouse that "this is the place to live."

Choosing the site

I started on my ham crusade by obtaining geodetic and survey maps for the entire state, and then spent a great deal of time studying them and visiting many proposed locations. Was the subject QTH far enough from heavily traveled highways so as not to be subject to automobile ignition noise? Finding proposed locations was relatively easy but finding the ones that had land available and accessible was another problem. I recall many disappointments.

I made my choice and I'm happy to report that between 1959 and 1978 I had the greatest ham location that one could ask for—and one every ham should experience. There were certainly many higher locations available throughout the United States but were they within radio metropolitan range of an area such as New York City? Mine was, and that added so much joy to the ground-wave contacts, which had an approximate radius of 200 airline miles. The QTH I had chosen was about 40 miles northwest of Central Park, New York City; for those familiar with New Jersey, it was in Jefferson Township at the intersection of Morris, Passaic and Sussex counties. It was on the northwest ridge bordering the Oak Ridge Reservoir, which supplied water to the city of Newark. My five acres of property bordered on thousands of acres belonging to the City of Newark Watershed.

There were no restrictions on antennas. I could put up anything I wanted. I settled on a seven-element triband beam for 20 through 10 meters and antennas ranging from 11 elements on 6 to 20 elements on 2, not to mention full-size dipoles on 80 and 40 meters. Life was good!

Another desirable factor in a great QTH was to have a low-noise location, radio-wise. This was borne out by the constant "whistlers" (part of an ionosphere phenomenon) I would detect in the 20 to 30 MHz range. I would pick them up slightly higher than 30 MHz and observe on a panalyzer as they waddled down in frequency (it really looked like waddling) until they diminished somewhere about 20 MHz after sort of "FMing" themselves to death.

Some highlights

I can recall one winter snowstorm when all travel came to a halt. I heard some QRN on the 15 meter band that sounded like noise being generated from some type of an electrical appliance. I left the door of the radio shack open,

caused that interference; the signals weren't that strong and besides, I couldn't find anyone else who could hear it to confirm its presence.

I remember, with delight, many evening ground-wave QSOs with New York City/Long Island hams which put my antenna in the direction of South

"I could put up anything I wanted—life was good!"

stepped out into the snowbound road and looked down into the valley where I could see a section of Route 23 in Stockholm, New Jersey, which was approximately three miles away. I heard the noise in the receiver and simultaneously spotted a puff of smoke coming from a snowplow. This was repeated several times until I realized that the snowplow was the source of the noise and since it was diesel-operated, what I was hearing was not ignition noise, it was alternator noise—three miles away. Early morning differences in noise background could be detected depending upon the pointing of the antenna with respect to the sun. I can recall observing some weird noise which sounded like a mishmash of several signals when the antenna was pointed in a certain direction, which happened to be towards the abandoned Edison mines, about eight miles away. I never did find out what

Africa. The band was dead with respect to skip, but on many occasions ZSs would break in just to let me know that I was the only stateside station being heard. I guess having a Henry 2K4 and six elements on 15 didn't hurt. On many occasions I would work 15 meter ground-wave stations at a distance of approximately 200 miles and the ham on the other end would excuse himself so that he could work "other short skip stations."

So why did I give up this ham paradise? It was just time to do something else. I sold all my possessions, bought a sailboat and lived aboard while spending the next 15 years in the sunny Caribbean between Puerto Rico and the Virgin Islands.

Within the past year I had occasion to be within five miles of my old QTH and couldn't resist visiting. My old ham shack was now in use as a garage—to coin a cliché, you can't go home again.

73

NEVER SAY DIE

Continued from page 79

Step one is to design the transmitting and receiving units. Keep 'em simple. Sure, I'll be glad to publish your solution, if it looks promising. And yes, any manufacturers who decide to use it should pony up a 2% on gross sales royalty to you too.

Once something like this starts to catch on, every restaurant will have to invest in a system.

My preference would be to use infrared—like your TV remote control units. With a little power a table unit can cover a large area. A booster can be installed if needed to cover the kitchen.

LETTERS

Continued from page 62

While waiting for one of their security people to drive me back to my apartment, the Colombian Navy captain and I were alone and he told me about an encounter one of their frigates had with a UFO one night while on patrol along the Colombian coast. Recently I

Hey, do Sherry and I get some free meals out of this?

Selling Music

For that matter, you should be able to make a nice living selling audio systems to restaurants, complete with CD players and a set of appropriate ethnic music CDs. Mexican music for Mexican restaurants; Italian, Chinese, and so on. The sales and service in providing good music for a few hundred restaurants should keep you out of trouble. The next thing you know you'll be on your way to Mexico, portable digital recorder in hand. Or Greece. Or Japan. Oh, and don't forget that 2% for Wayne. On gross sales.

73

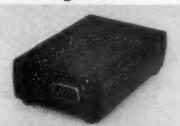
had a Colombian AF colonel in one of my classes at DLIELC, so I asked him if he had ever been given a briefing in which he was told that we have been having extraterrestrial visitors. Looking at me directly, he responded, "Yes." Most Colombian AF officers apparently have not had such a briefing, only those working at the highest levels.

Continued on page 82

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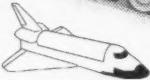


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LETTERS

Continued from page 81

A couple of years ago I participated in a MUFON investigation of a family's encounter with a UFO that had hovered over their farmhouse near San Antonio, frightening them badly. There were three witnesses: a mother and two of her children. The 13-year-old daughter stayed outside looking at the craft the longest and experienced some physical symptoms (sunburn, fever, etc.). All felt heat and came down with colds shortly afterwards. The younger son will not go outside the house alone anymore and the daughter couldn't sleep at night for long afterwards. Other strange things occurred that evening and there is some suspicion that one or more family members were abducted. The UFO phenomenon is quite bizarre and I'm also puzzled, amused and frustrated by the strange human response. Why aren't more people eager to find answers to the questions being raised?

That's simple, Cliff: We believe what the government tells us. The government wouldn't lie to us. But then there are a few troublemakers like you and me. I personally know the government is still lying about Amelia Earhart, even after 60 years.

A few years ago I was called by a farmer to look at some crop circles in Francestown, NH. I talked with the woman who lived next to the farm and she told about a UFO that had hovered over her house for several minutes a few nights previously, scaring the heck out of her and her children. When her husband got back he ridiculed her and the kids. The next day he apologized when he reported that the staff at the Crotched Mountain Children's Rehabilitation Center a few miles away reported the same silent bright light hovering over their buildings that same evening, and then zooming away at an incredible clip.

Then there's a chap with the highest security clearance who is a consultant to President Clinton who called me a few days ago. He's had several contactee experiences himself and his son, in Annapolis, reports that they are teaching the upper class students

that the ETs are already here. I do wish someone would teach these critters to talk instead of always using telepathy, and lend them some HTs so we could let them hear what a pileup sounds like... Wayne.

John Peters K1ER/KH6. You asked for a report on Dayton. Well, in brief, it stank. The WX used to be wet and cold, which was easy to handle with a waterproof jacket. This year the stupidity of the shift to May was demonstrated by pouring rain for several days before the Hamvention, making it possible for the humidity to be unbearable on Friday and Saturday when the temperature was unbearably hot. The flea market seemed to be about 50% full, with many of the spaces purchased by people looking for a close-in parking space. Nothing in the flea market space but a parked vehicle. The flea market was not taken over by computers, it was taken over by completely useless junk—old lab equipment (junked by hospitals), old telephone equipment junked by some telephone company. Much less ham gear or computers than before. The tent area, normally known for the two or three inches of water running over your feet, was hot and humid, and contained basically the stuff that didn't sell at the local Radio Shack. The flea market was a bust. The inside displays were the same gang as usual. It would be hard to tell one year from another, except that it was hot.

You should have had your own forum in competition with those scheduled. Best example was the DX forum. Scheduled to start first thing in the morning with a set schedule of topics. So far so good. The first event was Bill K from the DXCC desk who was scheduled to talk for 30 minutes or so. He took five to say the card checking backlog is gone and all's well with the world. The DXAC chair then announced that there was really nothing controversial going on with the DXAC (probably the most blatant statement before the presidential lies started) and sat down. With no questions or arguments, and since the forum was then approximately 50 minutes ahead of schedule (the later speakers had not arrived), they

just adjourned! The speakers arrived to find an empty hall. The DX Dinner was not improved over prior years. But anyone who doesn't know that deserves bad food, bad acoustics and bad service. I was supposed to help open a hospitality suite 30 minutes before the scheduled end of the DX banquet, and at that appointed time the banquet food had not yet been served. I could discuss other events, but why bother? The only reliable high spot was the bar on the top floor above the DX dinner, which was as good as ever in spite of the hotel sale to the Holiday Inn chain and name change. Same friendly staff every year.

They should move the event back to April when the weather can at least be compensated for with clothing. Don't ask why any sane person would go from Hawaii to Ohio in May! I figured it was close enough to the International DX Convention in Visalia, so why not? Now I know why not. At least the museum at Wright Pat had a few new exhibits, and I saw a few hams I knew. I may go next year just for the Collins Collectors meeting and skip the rest. I figure Slick Willie is going to get us into a war in Korea again by continuing to weaken the military, and the troops will need phone patches home. I need more things for the MARS frequencies before it starts.

I had expected to hear you at Dayton; sorry you weren't there. If you want to lose weight, the food and heat will sweat off a few pounds. I'm not sure any magic is involved in living long. Just stay away from doctors and hospitals (that's where the pathogenic organisms are found!) and have DNA from great-great-grandma who lived to 104, grandparents to 98, and eat less.

Hmm, by publishing your letter I've probably guaranteed that I won't get invited to speak next year. C'est la vie. But, how about some positive letters? Some of you must have had a really good time! Speak up. However, with that humidity and temperature I can understand why the speakers didn't want to talk very long. The thought of around 50,000 pounds of ham fat in a closed steam room is challenging.... Wayne.

Number 83 on your Feedback card

UPDATES

Resistance is futile?

If you look at Fig. 1 of "Enhanced Automatic Voltage Controller" on page 43 of the January issue you'll see that we neglected to label one of the resistors. The resistor right next to R12 is R11.

Frank-ly speaking...

In Frank Brumbaugh's "Audio Filter Alignment Generator" from the December issue (page 42) there was a typo in Fig. 1. The 3 was accidentally labeled 9.

In addition, Frank sent us a memo saying that there have been some problems with the 74LS90 chips: If the output from pin 11 of U2 does not divide by 5, you should take the output from pin 8 instead.

75

Bruce Muscolino W6TOY/3. Dayton Bombed? I think not! Seemed to me the crowd was pretty much on a par with last year. True, nothing like five years ago, but still a fun and worthwhile trip, and no rain!

One group of hams actually had a bumper year this year at Dayton—the QRPs. The story began in 1995. Traditionally, like many other special interest groups, the QRPs hold a separate meeting. Our meeting is sponsored by the QRP Amateur Radio Club International (QRP-ARCI) and is complete with a hospitality suite, vendors, radios to operate, and a place to sit and tell war stories to friends. QRP enthusiasts from around the world attend each year, with a large group coming from the G-QRP club.

QRP is thought by many to be the fastest growing segment of amateur radio today. Certainly there has been tremendous interest in low power operation as evidenced by regional and national club memberships in the thousands and an active Internet list with nearly 2,000 members. However, the "dumbing down" of ham radio over the last 25 years has led to many hams who have less than a solid working knowledge of the technology underlying their hobby.

Continued on page 85

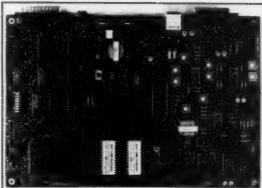
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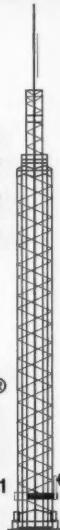
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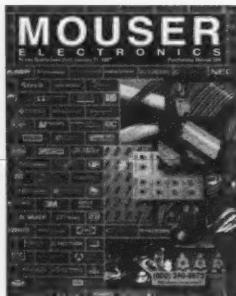
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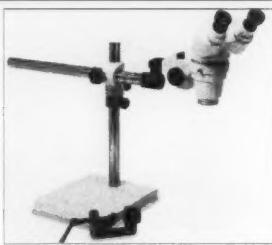
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The latest electronics components catalog from Mouser is now available—332 pages of more than 68,000 products from today's leading electronics manufacturers, including new additions from Switchcraft, Cornell Dubilier, SGS Thomson, Xicon, and more. You'll find complete specification drawings, guaranteed prices, and same-day shipping on all in-stock products. Buyers, engineers, and just plain catalog dreamers will want to latch on to this one. For a free copy, call (800) 992-9943; E-mail catalog@mouser.com; web site <http://www.mouser.com>; FAX (817) 483-0931.



Booming Stereo

WASSCO introduces the new Stereoscopic Microscope on boomstand from Clearview Instruments. The boomstand is available with or without a clamp base; the arm extends to 16 inches around the base, and, with a 360° swing arc, it will go virtually anywhere around your work surface. The clamp base adds even more portability and flexibility.

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Cross-Platform Compatible

Tripp Lite announces Version 9.0 of PowerAlert Plus UPS power management software, which is the only software that has the capability to work with software sold by American Power Conversion (APC).

Version 9.0 will perform all functions of APC's PowerChute power monitoring software, including full system shutdown, system test and power failure simulation. Since Version 9.0 is fully compatible with all APC software features, users of current APC UPS systems are no longer dependent on using only APC products. Users can now take full advantage of Tripp Lite UPS systems without reconfiguring their server installations.

Version 9.0 is a no-cost option with Tripp Lite SmartPro UPS systems. It is also available separately for \$89. For more information, contact Tripp Lite Customer Support at (312) 755-5401; FAX (312) 644-6505; E-mail: info@tripplite.com; web site: <http://tripplite.com>.

The Future 1 Is Now

It's smaller than a notebook, but so advanced it's set to revolutionize the telecommunications industry. The Future 1 Planar Satellite Antenna from *galaxis* can receive over 100 TV and radio stations, but its flat, compact design means it's much less obtrusive than traditional dishes. The totally weatherproof design ensures continual maximum reception for home and mobile installations, like RVs and boats. The Future 1 can also receive both analog and digital satellite stations, and it's just the first in a whole family of new antenna products from *galaxis USA Ltd.* See your antenna dealer.



New Free Catalog

MCM Electronics, for 20 years a leader in the distribution of consumer electronic repair parts and accessories, has released their new catalog. More than 6,000 items, including project accessories, semiconductors, connectors, test equipment, hundreds of original and generic TV/VCR parts are at your fingertips. New sections are included: computer software, gaming and amusement, printer parts among them.

Franchised lines offered for the first time in this catalog include Lexmark, ECG/Philips, and Sencore. Name brand offerings have been expanded to include Brax, Sovtek, and more.

Approved, in-stock orders received by 5 p.m. will be shipped the same day. For a free copy of this new catalog, write to MCM Electronics at 650 Congress Park Dr., Centerville OH 45459-4072, or call 1-800-543-4330.

Kepro Named Distributor

Kepro Circuit Systems, Inc., a St. Louis-based worldwide supplier of etched circuit board equipment and supplies, has been named one of the US distributors of KPR Liquid Photoresist products by Fry Metals. KPR is a high resolution liquid photoresist for fine line detailing of etched circuit boards. Designed specifically for undiluted use on copper, copper alloys, and anodized aluminum plates, KPR products are negative-acting photoresists for dip coating, flow coating, spray coating, and roller coating applications. Coatings can be air-dried or infrared oven-dried. Exposure is done with carbon-arc lamps,

mercury-vapor lamps, pulsed-xenon lamps, and unfiltered ultraviolet fluorescent tubes. KPR products require specific developing solutions designed to be compatible with each photoresist. Since 1954 Kepro has provided state-of-the-art equipment and supplies for prototyping and short-run production of etched circuit boards, and Kepro products are available virtually anywhere in the world. For more information, contact Kepro Circuit Systems, Inc.; 630 Axminster Drive, Fenton MO 63026-2992. E-mail: kepro@worldnet.att.com, or call (800) 325-3878; Fax (314) 343-0668.

AM Radio Log

The National Radio Club's 17th Edition of their *AM Radio Log* is now available. Its 312 pages list the US and Canadian AM broadcast stations by frequency from 530-1660 kHz, with a cross reference by call letters and city. The listing includes the call, address, format, networks, phone number, day and night powers, antenna, time zone, and slogans. With 191 listed stations on 1230 kHz, a person could make a career out of logging everything on one frequency. The list comes on 8-1/2" x 11" paper, punched for a binder. The Club also has lists available of Latin American, European, and all other stations. Box 164, Mansville NY 13661.



LETTERS

Continued from page 83

Last year, Bob Gobrick WA6ERB/VOIDRB and I sat in the QRP-ARCI hospitality suite and kicked around an idea we hoped would change this. Coming from engineering backgrounds, we both have extensive experience with technical conferences and trade shows. And what else is Dayton if not a trade show with a few technical conferences thrown in? We thought that a QRP technical conference would enhance everyone's enjoyment of the QRP activities, and perhaps even raise their level of technical knowledge.

We envisioned some of QRP's "great white heads" holding forth on topics of interest to all: what's the best antenna, what's the best band, how do radios really work, how do you build a radio, etc. We decided on the Thursday before the Hamvention opens. We thought there might be 20 or 25 of our fellow QRPers who'd use up an extra day of vacation and spring for the extra expenses. Surprise, surprise—we had 105 enthusiastic QRPers in the audience. Dayton Bombed? Not at the Day's Inn—Dayton South! Yes, we're going to do it again next year, and you have my personal invitation to attend, free, on me!

How can I pass up a free meal? Meanwhile, Bruce, the more articles I can publish on QRP, the bigger turnout you'll have, so let's see articles on QRP rigs, reviews of kits, and so on. What's the best backpack antenna? ... Wayne.

Evan Rolek K9SQG. Your "How About Macs" editorial really got me going. Hams demand no-tune transceivers. They want automatic antenna tuners to match the impedance of their linear, keyers, voice synthesizers, automatic CW copiers, and motorized crank-up towers, so one might think that hams are lazy. But for some unknown reason they have an obsession with PCs and shun Macs. I heard a chap explaining proudly that it only took him two days to get his CD-ROM installed and working. With a Mac, even a novice can get a CD-ROM working in less than 10 minutes. I used to joke with PC users because, unlike with the Mac, they could only use eight characters to name files, and no uppercase, commas, blank spaces, etc. Now, with Windows 95® they're saying, "Hey, you know, I can name my files now!" Just compare the number of help books and help courses at local schools for PCs vs. Macs. Missed you at Dayton.

Golly, Evan, you convinced me! ... Wayne.

Don Blackys K9UQN. I just got through reading your editorial called "Debacle?" in the September 73. My response to your comments is that you are applying what happened to us as youngsters to a new time and place. That is difficult to do. In your opening paragraphs you speak of that nasty group called "hams" who provide the least in the way of benefits to the public in return for their use of billions of dollars of spectrum. Really? I started on the ham bands back in 1959 with a Novice license. Today I hold the amateur Extra, all four FCC Commercial licenses, a masters degree, and have the title Systems Design Architect and Engineer, Motorola Land Mobile Products Group. I am designing some of the most sophisticated digital encrypted land mobile products that will benefit an entire world of people. And those products encompass everything from better spectrum utilization to the most "uncrackable" encryption methods to be used for customers like United States Secret Service, FBI, US Border Patrol and US military customers. And where did it all start and where does it continue? With

my love for radio, which was sparked by ham radio back in 1959. Our company has many hams working on hundreds of diverse projects to aid mankind now and in the future, and this includes using microprocessor controls for everything from the cars we drive to the microwave ovens we cook in. Where did these engineers get their start? Ham radio.

Yes, Wayne, it appears on the surface (to you) that amateur radio is becoming a waste. And if you look at Dayton on the surface, yes, there are some real lowlifes that are entering the hobby, but they are the same lowlifes that take up a slot in life, drink beer and don't give a hoot for their country and/or fellow man.

You made a statement that alluded to ham clubs not helping youngsters understand radio and electronics. Have you ever taught a class recently? I have taught over 400 people now everything from the Novice through Extra and the Commercial FCC exams. You know what everyone wants today? They want a license to either chat on the radio or get a job they won't be able to handle. It has nothing to do with ham radio; it has to do with the fundamental idea that our government in this country has encouraged: That failure is OK, reading books is boring, and you get a job just because you are a minority. The kick-ass, get-tough, dig-in-and-fight attitude is gone in the United States. Look at how simple the ham exams are today. I teach the no-code in four evenings and have had 75 students so far score no less than a 90 on any element they take. Where's the 1960 attitude of "Two-thirds of you first flunked your Extra theory (10 questions, of which 10 were draw-the-schematics)"? We have become a soft, give-away country, Wayne. Why not ham radio? Give it away to a bunch of morons whom the government can then control. That's the bottom line.

I go through this every day—seeing newly graduated engineers who got straight A's in engineering school not be able to tell me how RF energy gets from the transmitter to the antenna down a coaxial transmission line. They have no idea, yet when I check their records: An A in Fields class. Give the grades away so our colleges can remain in business.

Straying away from ham radio for a minute, I am also a private pilot with an instrument rating. I have talked to many of my ham buddies who fly as captains with major airlines. I have asked them point blank, "Is there a movement in the United States to get rid of private pilots in American airspace?" The answer has been a resounding "Yes!" Might as well, Wayne; they fit your guideline of "least benefits to the public in return for their use of billions of dollars of spectrum (airspace)."

Say what you want, Wayne, it's your magazine and your feelings. But don't blame ham radio. It has and will remain a vehicle for people to have fun with electronics and explore the field of RF communications. Who knows who the next engineer we hire will be. He might be the kid we are looking for to develop a new encryption method because he has been reading in depth on digital coding methods—something that was a spin-off of high-speed packet radio operation. I hope you will lighten up, Wayne.

Don, I'll lighten up when I see some articles coming in from you to help get the readers interested in pioneering ham digital voice communications. But my main message is that either we start cloning hams like you in quantity or we're gone. Sure, we have a few youngsters coming into the hobby and going for high-tech careers, but it's about one-tenth as many as we used to provide the electronics industry. Meanwhile the industry has grown by a hundred times, and shows no sign of slowing down. Don, I read a thick stack of ham club newsletters every month and only a few show any signs of serious recruitment and giving theory classes. Our kids' low grades and lack of motivation are a product of our government-controlled school system. If we can get the government the heck out of our schools (and a bunch of other similar expensive failures) we'll be a whole lot better off. Eventually if there's no quid, there isn't going to be any quo... Wayne.

Don Lawshe NW2S. In reference to obtaining adhesive-backed copper foil for antenna construction, any craft dealer worthy of the name handles this tape, generally in the "stained glass" section. My

Continued on page 86

BARTER 'N' BUY

Turn your old ham and computer gear into cash now. Sure, you can wait for a hamfest to try and dump it, but you know you'll get a far more realistic price if you have it out where 100,000 active ham potential buyers can see it than the few hundred local hams who come by a flea market table. Check your attic, garage, cellar and closet shelves and get cash for your ham and computer gear before it's too old to sell. You know you're not going to use it again, so why leave it for your widow to throw out? That stuff isn't getting any younger!

The '73 Flea Market, Barter 'n' Buy, costs you peanuts (almost)—comes to 35 cents a word for individual (noncommercial) ads and \$1.00 a word for commercial ads. Don't plan on telling a long story. Use abbreviations, cram it in. But be honest. There are plenty of hams who love to fix things, so if it doesn't work, say so. Make your list, count the words, including your call, address and phone number. Include a check or your credit card number and expiration. If you're placing a commercial ad, include an additional phone number, separate from your ad.

This is a monthly magazine, not a daily newspaper, so figure a couple months before the action starts; then be prepared. If you get too many calls, you priced it low. If you don't get many calls, too high.

So get busy. Blow the dust off, check everything out, make sure it still works right and maybe you can help make a ham sure it still works right and maybe you can help make a ham newcomer or retired old timer happy with that rig you're not using now. Or you might get busy on your computer and put together a list of small gear/parts to send to those interested?

The deadline for the April 1997 classified ad section is February 12th, 1997.

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LETTERS

Continued from page 85

local dealer has it for \$3.49 for 12 yards. A nation-wide distributor is Dick Blick Art Materials (800-723-2787); their item number is 606-3601, price \$3.20 for 12 yards, plus shipping. However, be sure and get copper tape, not the lead tape some dealers also carry. The copper foil (tape) originally was intended to wrap the edges of "Tiffany" type stained glass ornaments and windows.

OK, antenna weather is here—still winter, so I want to see a bunch of "Curses, Foiled Again" antenna construction articles... Wayne.

Craig Roberts WB5HKO/1.

I've just read your wonderful editorial on entrepreneurship. Good job! A year ago I was an out-of-work advertising copywriter and ex-radio announcer feeling terribly sorry for myself; abused by society and victimized by a "bad economy." My pathetic mood was exacerbated by the necessity of selling the contents of my modest shack in order to meet a mortgage payment. My God, evil and overwhelming forces had forced my to give up not only my dignity as a family provider, but the trappings of my beloved hobby as well. Things couldn't be worse! Woe was me. Then, during one of many telephone calls to "Help Wanted" advertisers I was put on hold. While in that telephonic limbo, I heard several minutes of informative promotional messages for the company I had called. "Hmmm," I thought, "I could do that. I could write, produce and sell telephone on-hold messages." The disciplines involved were well within my professional capabilities and the investment needed to get into the business was nearly zip. I excitedly told a few friends about my plan and was met by doomsaying: "Start your own business in conservative old New England? You must be mad! The economy's terrible and no one will buy your radical service!" Having nothing better to do, I persevered. I went door to door taking orders and small deposits. With the deposit money I rented some audio equipment and delivered on my promises. It worked wonderfully. Mine isn't the largest on-hold company in the country, but *Continued on page 87*

PROPAGATION

Jim Gray W1XU
210 Chateau Circle
Payson AZ 85541

February is likely to be a rather "blah" month (again) for DX propagation due to generally depressed seasonal and cyclical solar flux values, which have hovered in the high 60s and low 70s for almost a year. However, it is expected that there will be favorable increases in solar flux—hence DX propagation—during late summer and fall.

On the brighter side, noise levels (QRN) should be fairly low

this month, and few days are expected to present any great storm activity in either atmosphere or ionosphere. You may want to try your DX ability on the 6th, 11–12th, and 21–22nd while avoiding the days surrounding the 3rd, 17th and 27th.

Listen often to WWV at 18 minutes after any hour. The 10 MHz frequency is best for me but you may wish to try 5, 15 or 20 MHz for best reception at your QTH. Best "conditions" will appear when the "A" and "K" indexes are low (Boulder K less

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ARGENTINA	20	40	40	40	80	80			20	15	15	
AUSTRALIA	20		20		40	40	20	20		15	15	
CANAL ZONE	15	20	20	40	40		20	20	15	15	15	15
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HAWAII	20		20		40	40	80	20		15	15	
INDIA	20					20	40	20			15	
JAPAN	20						20	20			20	
MEXICO	15	20	20	40	40		20	20	15	15	15	15
PHILIPPINES							20					
PUERTO RICO	15	20	20	40	40		20	20	15	15	15	15
SOUTH AFRICA				40	40				15	15	15	20
U.S.S.R.	40	80	80	40			20	20	20			40
WEST COAST		80	80	40	40	40	20	20	20			

CENTRAL UNITED STATES TO:

ALASKA				80	40	20						
ARGENTINA	20		40	40	40				15	15		
AUSTRALIA	15				40	20	20	20		15		
CANAL ZONE	20	80	40	40	40	40	20	20	15	15	15	20
ENGLAND	40	40	40	80				20	15	20		40
HAWAII	15	20			40	40	40			15	15	
INDIA	15	20	20				40	20	20			
JAPAN						80	40	20				
MEXICO	20	80	40	40	40	40	20	20	15	15	15	20
PHILIPPINES							20					
PUERTO RICO	20	80	40	40	40	40	20	20	20	15	15	20
SOUTH AFRICA	20	40							15	15	20	20
U.S.S.R.	40		40	40				20	20			

WESTERN UNITED STATES TO:

ALASKA	15	20			40	40	40	40	40			20
ARGENTINA	15	20			40	40	40	40	40	15	15	15
AUSTRALIA	15	20	20				40	80	40	15	15	15
CANAL ZONE	20	20			40	40	40			20	15	15
ENGLAND			80	40					20	20		
HAWAII	15	15				20	20	20	20			15
INDIA		20										
JAPAN	15	20				40	40	40	40			20
MEXICO	20	20			40	40	40			20	15	15
PHILIPPINES	15	20					40	40	20		20	
PUERTO RICO	20	20			40	40	40			20	15	15
SOUTH AFRICA	20	40	40							15	15	20
U.S.S.R.		40	40	40	40				20	20		
EAST COAST		80	80	40	40	40	20	20	20	20		

FEBRUARY 1997

SUN	MON	TUE	WED	THU	FRI	SAT
						1 F
2 F-P	3 P	4 P-F	5 F-G	6 G	7 G-F	8 F
9 F	10 F-G	11 G	12 G	13 G-F	14 F	15 F
16 F-P	17 P	18 P-F	19 F	20 F-G	21 G	22 G
23 G	24 G-F	25 F	26 F-P	27 P	28 P-F	

than 3 and A less than 10) with accompanying solar flux values moving upward into the 80s and 90s.

Don't give up...better times are coming, and the skills you develop now will stand you in good stead when propagation improves. W1XU.

10–12 meters

A few possible daytime F2 layer openings to South and Central America on the Good (G) days.

15–17 meters

Fair DX openings on Good (G) days between noon and sunset, and short-skip openings during the daylight hours. The band dies at sunset.

20 meters

DX to most areas of the world during daylight hours, peaking a few hours after sunrise and again during the early afternoon. Although the band usually closes soon after sunset, you may find occasional openings to South America and Antarctica until midnight. Daylight short skip from several hundred to 2,000 miles or so possible on most Good (G) or Fair (F) days.

30 meters

DX toward Europe in the late afternoon and evening on Good (G) days until midnight, and then toward the Orient in the early sunrise hours. Possible long-path DX in the morning and also short skip most days out to a thousand miles or more, and farther in the evening.

40 meters

DX toward Europe and Africa in late afternoon hours, toward South and Central America around sunset, and good openings to the West and South Pacific peaking around sunrise on Good (G) days. Expect daytime short skip to 1,000 miles, and 2,000 miles at night.

80–160 meters

Both are excellent bands for DX during hours of darkness, peaking at midnight and just before dawn. Daytime skip on 160 is nonexistent, but on 80 it can be up to 500 miles, and over 2,000 miles at night. On 160, short skip can reach from 1,000–2,500 miles at night. Experts prefer vertical polarization for transmitting antennas (low-angle signal take-off) and horizontal polarization for receiving antennas (less noise) on 160 meters.

LETTERS

Continued from page 86

none offers better service or a superior product—and I've recently expanded my business to provide custom newsletters and collateral marketing materials for small businesses. I'm now totally self-sufficient and better off than ever financially. And my company's only a year old! The best is yet to come. As you so convincingly said: Yes! It can be done! On behalf of the many you will inspire—thanks!

All it takes is Motivation, Determination, and Perseverance and you can do just about anything. And I'd much prefer to hear something promotional than the crappy music most on-hold services use... Wayne.

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HAM HELP

We are happy to provide Ham Help free on a space-available basis. To make our job easier and to ensure that your listing is correct, please type or print your request clearly, double-spaced, on a full 8-1/2" x 11" sheet of paper. Use upper- and lower-case letters where appropriate. Also, print numbers carefully. A 1, for example, can be misread as the letters I, i, l, or even the number 7. Specifically mention that your message is for the Ham Help Column. Please remember to acknowledge responses to your requests. Thank you for your cooperation.

Any Yaesu Hints?

I have a Yaesu FT-51R-HP Dual Band Transceiver with high power battery pack, digital display microphones and cigarette lighter adapters. The unit will not stay on high power but reverts to a lower power setting. How can I achieve the specified 5 watt output from this radio and how can I get it to stay on the high output setting of 5 watts when it is selected? Yaesu has already fiddled with this unit and returned it to me but the problem still occurs. Please respond to George T. Platt NIUUN, P.O. Box 21, Guild NH 03754.

Pirates of the Caribbean

The hams of Guantanamo Bay are in a quandary. Rusty Auxier KG4AU, President of the Guantanamo Bay ARC (KG4AN), writes:

"We have about four hams here who are active on HF, and it is sometimes difficult to QSL due to the fact that our club call,

KG4AN, has been deleted from Callbooks for the last few years. I just received my copy of *Radio Amateur Callbook* on CD-ROM, and discovered my stateside call said 'QSL via KG4AN' but there was no address for KG4AN. Of course, people wishing to QSL can go through the bureau, but that adds a lot of extra time. The QSL route for any KG4?? hams is as follows:

G.A.R.C./ATTN: KG4??
PSC 1005 Box 73
FPO AE 09593-0173.

"By the way, there are several pirates out there using KG4 callsigns. A few known ones are KG4AA, KG4AB and KG4US. Here is a list of the active hams who are live on the island:

KG4AU - Rusty Auxier
KG4WD - Wayne Duncan
KG4KD - Kim Duncan
KG4CQ - Tom Mann
KG4HE - Ray Magorno

"We do have visiting hams here on a regular basis, most notably KG4GC, Bill Gallier. If there is any doubt about the validity of a call, you can write us at the above address, ATTN: KG4AU, or for those hams on-line, the E-mail address is Rustman@AOL.COM."

75

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You can buy just the receiver PCB module in kit form or buy the kit with an attractive metal cabinet, AC power adapter, and built-in speaker. It is also available factory wired and tested.

- RWX Rcvr kit, PCB only \$79
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- Weather Satellite Handbook \$20



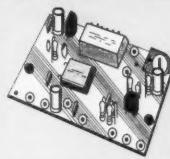
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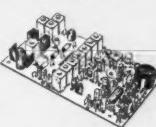
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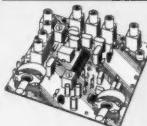
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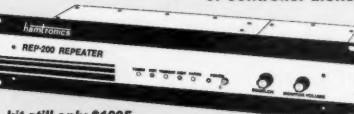


- Xmitting converters (at left) for 2M, 432 MHz.
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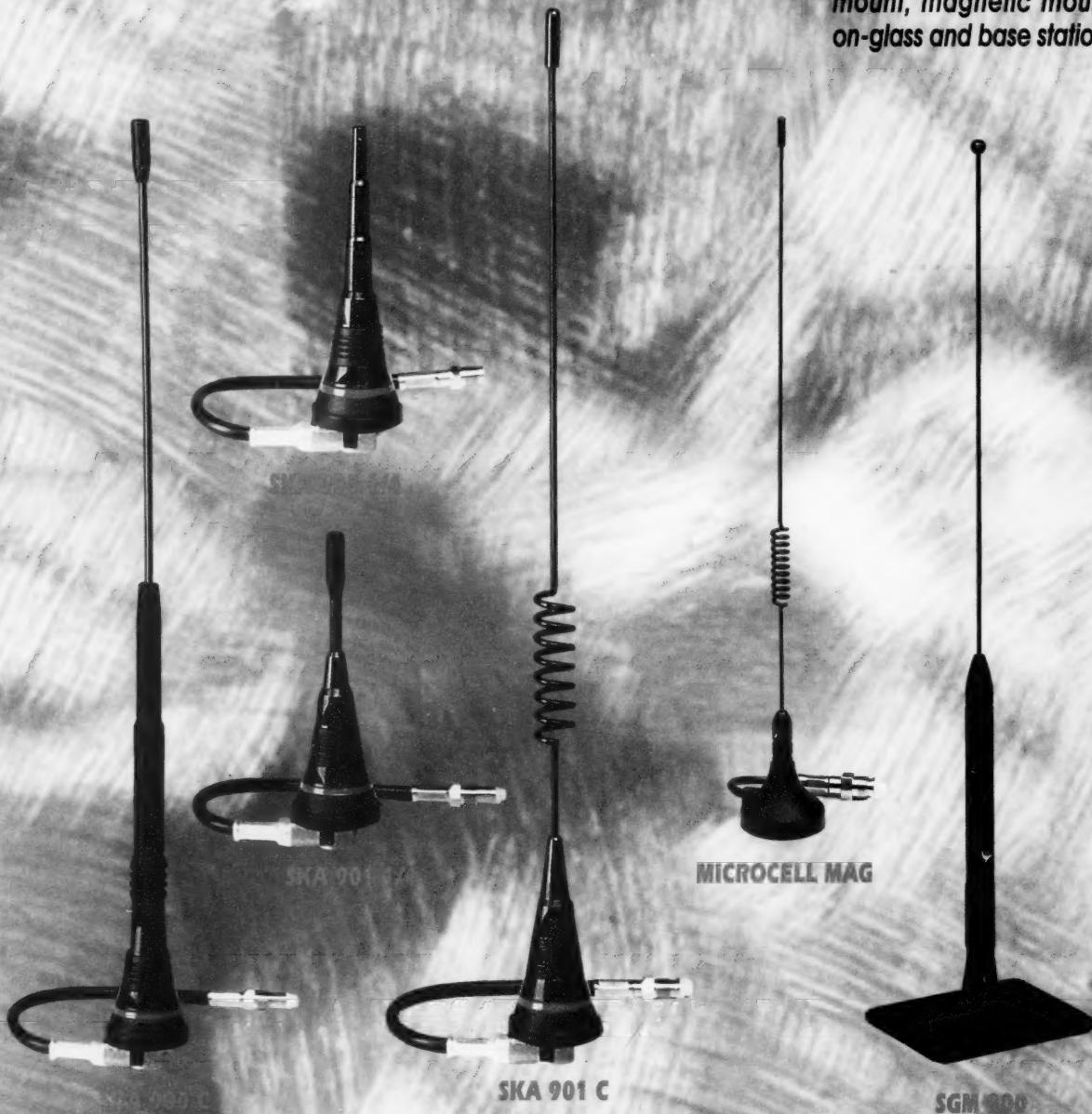
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